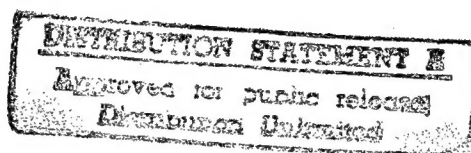




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Science & Technology

***Central Eurasia:
Space***

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Central Eurasia: Space

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CONTENTS

1 April 1992

Manned Mission Highlights

Officers Threaten to Stop 17 March Launch [IZVESTIYA 11 Mar 92]	1
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Space Sciences

Consortium Proceeding With Solar Sail, Solar Illumination Projects [Yuriy Meshkov; NEZAVISIMAYA GAZETA, 9 Jan 92]	2
Modification of the Simplex Method of Linear Programming for Degeneration [M. L. Lidov; KOSMICHESKIYE ISSLEDOVANIYA, Vol 29 No 4, Jul-Aug 91]	2
A Priori and A Posteriori Estimation of Errors Associated With Prediction of Motion of Low-Altitude Satellites [A. I. Nazarenko; KOSMICHESKIYE ISSLEDOVANIYA, Vol 29 No 4, Jul-Aug 91]	2
Nonperiodic Motions of a Satellite-Gyrostet in an Elliptical Orbit Around the Center of Mass [M. V. Demin; KOSMICHESKIYE ISSLEDOVANIYA, Vol 29 No 4, Jul-Aug 91]	3
Optimal Trajectories in Gravitational Fields Allowing Approximation With the Central Linear Field [A. G. Azizov, N. A. Korshunova; KOSMICHESKIYE ISSLEDOVANIYA, Vol 29 No 4, Jul-Aug 91]	3
Mathematical Modelling of Eulerian Turns of the Mir Orbital Complex by Gyrodynes [V. A. Sarychev, M. Yu. Belyayev, et al.; KOSMICHESKIYE ISSLEDOVANIYA, Vol 29 No 4, Jul-Aug 91]	3
Dynamics of Flux of Electrons and Low-Frequency Emissions During a Magnetic Storm [Yu. B. Mineyev, I. B. Volkov, et al.; KOSMICHESKIYE ISSLEDOVANIYA, Vol 29 No 4, Jul-Aug 91]	3
Dynamics of Multicomponent Ion Ring Current During Storm of 12-13 August 1985, From Results of Measurements Made by Gorizont and AMPTE/CCE Satellites [A. S. Kovtyukh, M. I. Panasyuk, et al.; KOSMICHESKIYE ISSLEDOVANIYA, Vol 29 No 4, Jul-Aug 91]	4
Energy Spectra High-Energy Electrons and Positrons Below the Earth's Radiation Belt [S. A. Voronov, A. M. Galper, et al.; KOSMICHESKIYE ISSLEDOVANIYA, Vol 29 No 4, Jul-Aug 91] ..	4
Interpretation of Electron Concentration Measurements Made by the Vertikal-4, -6, and -7 Rockets [A. V. Pavlov; KOSMICHESKIYE ISSLEDOVANIYA, Vol 29 No 4, Jul-Aug 91]	5
Generation of ULF and VLF Emissions in Inhomogeneous Plasma in the Plasmapause Region [N. I. Izhovkina, V. I. Larkina; KOSMICHESKIYE ISSLEDOVANIYA, Vol 29 No 4, Jul-Aug 91]	5
Measurement of Magnetic Field Vector From Rotating Spacecraft [M. K. Trubetskov, Ye. G. Yeroshenko, et al.; KOSMICHESKIYE ISSLEDOVANIYA, Vol 29 No 4, Jul-Aug 91]	5
Physical Properties of Phobos Rheolite [L. Ksanformaliti, V. Moroz, et al.; KOSMICHESKIYE ISSLEDOVANIYA, Vol 29 No 4, Jul-Aug 91] ..	5
Estimating the Mass of Halley's Comet Dust Particles From PUMA Data [Ye. I. Yevlanov, O. F. Prilutskiy, et al.; KOSMICHESKIYE ISSLEDOVANIYA, Vol 29 No 4, Jul-Aug 91]	6
External Thermal Loads for Gear Installed on a Spacecraft [G. A. Bril; KOSMICHESKIYE ISSLEDOVANIYA, Vol 29 No 4, Jul-Aug 91]	6
Stability of Attitude-Control Systems in Conditions of Random Interruption of Controlling Influence [G. Ya. Ledenev; KOSMICHESKIYE ISSLEDOVANIYA, Vol 29 No 4, Jul-Aug 91]	6
Statistical Distributions of Cosmic Gamma Bursts Registered in Soviet-French Experiments SIGNE-2MS (Venera-13, 14) and APEX (Phobos-2) [I. G. Mitrofanov, V. Sh. Dolidze, et al.; ASTRONOMICHESKIY ZHURNAL, Vol 68 No 4, Jul-Aug 91]	7
Formation of Planetary Systems in Course of Evolution of Close Binaries [A. V. Tutukov; ASTRONOMICHESKIY ZHURNAL, Vol 68 No 4, Jul-Aug 91]	7
Influence of Relativistic Effects on Results of Satellite Geodynamics, Geodesy and Navigation. Research Methods [N. V. Yemelyanov, A. V. Krivov; ASTRONOMICHESKIY ZHURNAL, Vol 68 No 4, Jul-Aug 91]	7

Research on Response of System for Tracking Motion of Artificial Earth Satellite [V. A. Bratchikov, A. I. Nazarenko; AVTOMATIKA I TELEMEXHANIKA, No 5, May 91]	8
Special Features of Astroclimate of Observation Point in Bolivia [G. A. Alekseyeva, A. A. Arkharov, et al.; KINEMATIKA I FIZIKA NEBESNYKH TEL, Vol 7 No 6, Nov-Dec 91]	8
Large-Scale Inhomogeneities in Universe and Spectra of Fluctuations [B. I. Hnatyk, V. N. Lukash, et al.; PISMA V ASTRONOMICHSKIY ZHURNAL, Vol 17 No 8, Aug 91]	8

Interplanetary Sciences

Models of Lunar Structure and Origin [Ye. L. Ruskol; ASTRONOMICHSKIY VESTNIK, Vol 25 No 4, Jul-Aug 91]	9
Lunar Geological Structure [A. L. Sukhanov; ASTRONOMICHSKIY VESTNIK, Vol 25 No 4, Jul-Aug 91]	9
Lunar Selenodesy and Cartography [V. S. Kislyuk; ASTRONOMICHSKIY VESTNIK, Vol 25 No 4, Jul-Aug 91]	9
Two-Color Photometry of Pluto [R. I. Kiladze, V. Dzh. Kukhianidze; ASTRONOMICHSKIY VESTNIK, Vol 25 No 4, Jul-Aug 91]	10
Iron and Chromium Absorption Bands in Spectra of Terrestrial Pyroxenes: Application to Remote Mineralogical Analysis of Surface of Asteroids [D. I. Shestopalov, L. F. Golubeva, et al.; ASTRONOMICHSKIY VESTNIK, Vol 25 No 4, Jul-Aug 91]	10

Life Sciences

'Bios' CELSS Experiments in Support of Manned Spaceflight Recounted [V. Nelyubin; KOMSOMOLSKAYA PRAVDA, 15 Jan 92]	11
---	----

Space Engineering

NPO Energiya Project for Orbital Solar Reflectors [M. Rebrov; KRASNAYA ZVEZDA, 13 Dec 91]	14
Use of On-board Television Survey of Phobos for Obtaining Navigational Information [N. A. Demchuk, N. M. Ivanov, et al.; IZVESTIYA AKADEMII NAUK SSSR: TEKHNIЧЕСКАЯ KIBERNETIKA, No 4, Jul-Aug 91]	14
Docking of Spacecraft in Elliptical Orbit [V. I. Popadinets, V. S. Burlaka, et al.; PRIKLADNAYA MEKHANIKA, Vol 27 No 10, Oct 91]	15

Space Applications

'Luch' Satellite, 'Gonets' System to Provide Medical Data Links [A. Blinov, B. Kononov; IZVESTIYA, 21 Dec 91 Union Edition]	16
Molniya-1 Communications Satellite Launched [TASS 5 Mar 92]	16

Space Policy, Administration

Ukrainian Goals in Establishing Independent Space Program Discussed [A. Chirva; POISK, No 49, 29 Nov-5 Dec 91]	17
Congress of Ukrainian Cosmonautics Federation L. Dayen, et al.; DEMOKRATYCHNA UKRAYINA 26 Nov 91	18
Collapse of Union Threatens Space Program [TASS 21 Jan 92]	19
Military Space Programs Must Adapt to New Conditions [Anatoliy Zak; NEZAVISIMAYA GAZETA, 21 Nov 91]	19
Military, Civilian Interests Competing Over Baykonur Cosmodrome [S. Brilev; KOMSOMOLSKAYA PRAVDA, 28 Dec 91]	21
Commentary on U.S. Radar Imagery Satellites [Yu. Makarov; KRASNAYA ZVEZDA, 18 Dec 91]	23
Projects Planned for 1992 International Space Year [M. Rebrov; KRASNAYA ZVEZDA, 24 Dec 91]	24
'Crisis' of Cosmonautics at Start of International Space Year [S. Leskov; IZVESTIYA, 14 Jan 92]	25
Responses to Missile Launch from Baykonur	26
Kazakhstan Not Informed [Radio Rossii]	26
Official Interviewed [Moscow TV]	26
Further on Launch [Moscow TV]	27

Views of Space Veteran N. Ye. Dmitriyev on Importance of Space Program [V. Petrova; VOZDUSHNYY TRANSPORT, No 1, Jan 92]	28
Roundtable on Space Program Status, Future [A. Tarasov; LITERATURNAYA GAZETA No 4, 22 Jan 92]	30
Uncertain Future of CIS Space Program [Vladimir Gubarev; PRAVDA, 17 Jan 92]	33
Political Factors Said to Predominate in New Space Policies [Ravil Zaripov; MOSKOVSKIY KOMSOMOLET, No 10, 17 Jan 92]	35
Strike Threat by Mir Flight Controllers Described as 'Final Cry for Help' [Vladimir Gubarev; PRAVDA, 28 Jan 92]	37
Military Officer Comments on Possible Nationalization of Space Installations [KRASNAYA ZVEZDA 6 Feb 92]	38
Economic Crisis at Dnepropetrovsk's Southern Machine Building Plant [M. Arkhipov; SYN OTCHESTVA, No 5, Jan 92]	38
Commentary on U.S.-Russian Space Cooperation [Moscow International 10 Feb 92]	40
Russian Space Officials Appear Before U.S. Senate Committee [Moscow International 24 Feb 92]	40
U.S. Personnel Flying Experiment on Mir Interviewed at Baykonur [Russian TV 4 Feb 92]	41
Legal Aspects of SETI [G. V. Silvestrov; ZEMLYA I VSELENNAYA, No 4, Jul-Aug 91]	42
Azerbaijan Establishes National Aerospace Agency [TASS 23 Feb 92]	44
Construction Battalion Mutinies at Cosmodrome	44
Barracks Set on Fire [Moscow TV 26 Feb 92]	44
Criminal Proceedings Instituted [Moscow Radio 26 Feb 92]	45
Situation Back to Normal [INTERFAX 26 Feb 92]	45
Further Details on Events [KRASNAYA ZVEZDA 27 Feb 92]	45
Seven Officers Dismissed at Baykonur [Radio Rossii 27 Feb 92]	46
Commissions To Investigate Baykonur Mutiny [PRAVDA 28 Feb 92]	46
Ukraine Plant to Cease Military Production [Radio Rossii 2 Mar 92]	46
Parody of Cosmonaut Commo Sessions Underlines Program Problems [A. Bogoslovskiy; NEZAVISIMAYA GAZETA, 26 Feb 92]	46
Early Space Failures Cited to Argue Against Continuation of Manned Flights [MOSCOW NEWS 1-8 Mar]	48
'Cosmosflot' Company To Offer Commercial Space Services [MOSCOW NEWS 16-23 Feb]	50
Dnepropetrovsk Company 'Gradient' Seeking Third World Space Business [MOSCOW NEWS 16-23 Feb]	50
Complaints of Baykonur Soldiers Confirmed [Moscow Radio 4 Mar 92]	51
Causes of Troop Mutiny at Baykonur Detailed [KRASNAYA ZVEZDA 12 Mar 92]	51
Head of New Russian Space Agency Interviewed [IZVESTIYA 28 Feb 92]	52
Ability of Ukrainian Group to Conduct Space Launches Questioned [KRASNAYA ZVEZDA 5 Mar 92]	53
Brazil Interested in Employing Space Experts [Radio Rossii 11 Mar 92]	54
Moscow Institute Developed Space Laser Systems [NEZAVISIMAYA GAZETA 26 Feb 92]	54

Officers Threaten to Stop 17 March Launch

927Q0101 Moscow IZVESTIYA in Russian 11 Mar 92
Morning Edition p 2

[Report by Vladimir Ardayev: "The German Will Be Put Into Space, If Our People Don't Go On Strike"]

[Text] The information agency "Asia-Press" has reported that a group of officers directly involved in carrying out manned launches at Baykonur have stated their intention to conduct a strike and, if their demands

are not met, to stop the launch of the joint Soviet-German crew scheduled for 17 March.

The officers are taking action against the difficult social and living conditions in the closed city of Leninsk, where their families live, and at the launch sites where they serve. They are taking action against the manifest inequalities among the various ranks—even in the most elementary everyday matters, and against the absence of legal limitations and the lack of juridical protection against the arbitrariness of the command which is so characteristic of such classified "points."

Consortium Proceeding With Solar Sail, Solar Illumination Projects*927Q0062A Moscow NEZAVISIMAYA GAZETA in Russian 9 Jan 92*

[Article by Yuriy Meshkov, "Moonlight on Order? In the Not Distant Future This Question May Sound Entirely Commonplace"]

[Text] It seems that the pessimism and low spirits prevailing in Soviet cosmonautics has not affected the "Kosmicheskaya Regata" [Space Regatta] Consortium, located in the Moscow area. The consortium, organized in August 1990, intends to mark the International Space Year, which is now beginning, with a unique experiment: the launching of the first solar "sailing ship" in the history of world cosmonautics. This should take place in October 1992, on the day of commemoration of the 500th anniversary of the discovery of America by Columbus.

The idea of movement in space under the influence of sunlight pressure was expressed by Tsander as early as the 1920's. And now the consortium formed by the Energiya Scientific Production Association and other space companies is close to practical realization of an exotic space journey using a solar sailing ship.

The demonstration flight in October will be the first step in the program, which has been given the name "New World." In this stage plans call for the testing of different methods for control of the solar sail with which the Progress transport ship will be equipped. The sail is being fabricated from a light film with a thickness 5 μ , capable of reflecting the sun's rays. The diameter of the main sail is 200 m and the diameter of the controllable sail is 120 m. Over the course of the three days during which the experiment will last plans call for finding not only the optimal method for controlling the sails, but also an attempt will be made to direct a spot of focused sunlight onto the Earth. This is necessary for implementing the second stage of the "New World" program. But first solar sailboats from Russia, the United States, France and Japan in late 1993-early 1994 are to participate in a space race along the Earth-Moon trajectory (it is not impossible that their flight will continue to Mars).

And finally, by 1995 plans call for constructing and launching into Earth orbit an experimental system for illuminating our planet from space. For this purpose illuminating systems consisting of four-six reflectors, fabricated from the same light-weight, light-reflecting film, will be installed. Situated at an altitude 3000-5000 km above the Earth, the reflectors will be able to produce on its surface a well-illuminated spot with a brightness up to 50 full moons and a diameter of several tens of kilometers. Such illumination will by no means be superfluous in regions of the Far North during the period of the polar night and when carrying out rescue and emergency work at nighttime in places where a misfortune or

major accident has occurred. An artificial extension of the light time of day also will assist during the period of harvesting of crops.

It is proposed that control of the "moonlight" be accomplished from a single center, to which will flow requests for additional illumination during the evening and nighttime hours.

With respect to the economic side of the project, the annual saving of electric power, according to preliminary computations, may be 35 million dollars. Only three-four years of operation will be required in order to completely recoup the expenditures on creating the space illumination system. But after five years an income of 420 million dollars is expected.

Participation in the project by the Energiya Scientific Production Association and its numerous partners—large and small space companies and enterprises—makes it possible to speak of the serious intentions of the Space Regata Consortium. In any case, the experimental copy of the craft, which is to make an experimental flight in October 1992, was recently demonstrated to journalists.

Modification of the Simplex Method of Linear Programming for Degeneration

927Q0051A Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol 29 No 4, Jul-Aug 91 (manuscript received 28 Sep 90) pp 499-508

[Article by M. L. Lidov; UDC 629]

[Abstract] A modification of a linear programming procedure advanced by B. Ts. Bakhshiyev [EKONOM. I MAT. METODY, 1989, Vol 25, No 2, p 314] is used to solve problems associated with controlling the flight of spacecraft. The reference basis and the reference surface are assumed to be degenerated, and the first k components of the reference surface are equal to zero. In analyzing flight trajectory correction and estimation of motion parameters from measurements, the researchers here focus on a typical ε -degeneration. The simplex method that is used reduces the computer time needed for problem solution. References 4 (Russian).

A Priori and A Posteriori Estimation of Errors Associated With Prediction of Motion of Low-Altitude Satellites

927Q0051B Moscow KOSMICHESKIYE ISSLEDOVANIYA in Russian Vol 29 No 4, Jul-Aug 91 (manuscript received 12 Mar 90) pp 509-516

[Article by A. I. Nazarenko; UDC 629]

[Abstract] A bank of orbital data for satellites flying at altitudes of 400 km or less was used in a posteriori estimates of prediction error. The satellites were aloft between December 1985 and February 1986, during which period there was little solar activity— $F_{10.7}$ was in the range of 68-103—but a great deal of geomagnetic

activity. In fact, a very strong geomagnetic storm was recorded in February, with a k_p value of 9. A total of 35 days witnessed the k_p value exceeding 3.5, i.e., 40 percent. The researchers also constructed an a priori model based on a stochastic representation of atmospheric disturbances. The two models produced data that were in good agreement and enabled the researchers to determine the parameters of the atmospheric density variation correlation function for various conditions. References 7 (Russian).

Nonperiodic Motions of a Satellite-Gyrost at an Elliptical Orbit Around the Center of Mass

927Q0051C Moscow KOSMICHESKIYE
ISSLEDOVANIYA in Russian Vol 29 No 4, Jul-Aug 91
(manuscript received 6 Jan 91) pp 517-524

[Article by M. V. Demin; UDC 531.36]

[Abstract] The motion of a satellite-gyrost at around a center of mass is examined for a keplerian elliptical orbit. Periodic solutions are found via the use of sufficient conditions for their existence proposed by Poincare ["Izbrannyye trudy" (Selected Works), Vol 1, Moscow: Nauka, 1971] and Pankratov ["Periodic Solutions of Hamiltonian Systems in Special Cases," Dissertation for candidate of physical-mathematical sciences, Moscow, 1986]. The satellite in the analysis is assumed to be dynamically symmetrical. The equations of motion that are derived are written in canonical form in Andoyer's variables. References 14 (Russian).

Optimal Trajectories in Gravitational Fields Allowing Approximation With the Central Linear Field

927Q0051D Moscow KOSMICHESKIYE
ISSLEDOVANIYA in Russian Vol 29 No 4, Jul-Aug 91
(manuscript received 19 Feb 90) pp 525-531

[Article by A. G. Azizov and N. A. Korshunova; UDC 531.01:629.73]

[Abstract] A problem is examined involving the integration of equations in which the motion takes place in a spherical layer of a central Newtonian field, with the thickness of the layer minimal by comparison with the distance to the gravitational center, thereby enabling both an approximation of the Newtonian field from the central linear field and a total analytical solution of the problem. With r_0 designating the average distance of a point from the gravitational center, gravitational acceleration is presented in the form $\mathbf{g} = -k\mathbf{r}$, $k = \mu/r_0^3$, where μ is the gravitational parameter. The system of equation integrals obtained indicates that the hodograph of the basis vector is an ellipse, a circle, or a straight line. The researchers base their study on an ellipse and find a solution for segments of maximum thrust. They pose a problem in which a point is moving in a central Newtonian field and must, with a minimum of mass expense, change its velocity from a local circular ellipse to an

ellipse elliptical in the pericenter and having an apocentric distance r_1 . In citing a numerical example of the relationship they ascertained between the extent ϕ of the segment of maximal attraction and the angle β (between the thrust vector and the velocity of the point) and the time of the maneuver, the researchers let r_0 equal 68×10^5 m, $\mu = 398,603 \text{ M}^3/\text{c}^2$ (for Earth), and $r_1 = 2r_0$. The duration of the segment of maximum thrust is found to be approximately equal to 150 seconds, with an angular extent of 11° . The thrust vector turns into the trajectory to an angle of approximately 6.5° . Figures 2, references 6: 4 Russian, 2 Western.

Mathematical Modelling of Eulerian Turns of the Mir Orbital Complex by Gyrodynes

927Q0051E Moscow KOSMICHESKIYE
ISSLEDOVANIYA in Russian Vol 29 No 4, Jul-Aug 91
(manuscript received 9 Aug 90) pp 532-543

[Article by V. A. Sarychev, M. Yu. Belyayev, S. G. Zykov, V. V. Sazonov, and V. I. Teslenko; UDC 65.012:2:629.198.3]

[Abstract] When the attitude of the Mir station is being controlled with a system of gyroscopes, or powered gyroscopes, that has reached saturation in terms of angular momentum, the system is relieved by reaction control jets. The firing of the jets, however, results in disturbances that are unacceptable for the performance of certain types of scientific research. Various mathematical models are used to predict the times at which the jets will be switched on, and in the work reported here, the researchers study Eulerian turns in inertial space, proposing three models for the operation. The models are executed in the form of programs that are run on an IBM PC/XT, and they differ in terms of the complexity of program implementation and speed. Two turns based on the models were performed for the Mir complex on 10 June 1987, as it observed the supernova SN 1987. Figures 8, references 5: 4 Russian, 1 Western.

Dynamics of Flux of Electrons and Low-Frequency Emissions During a Magnetic Storm

927Q0051F Moscow KOSMICHESKIYE
ISSLEDOVANIYA in Russian Vol 29 No 4, Jul-Aug 91
(manuscript received 17 Jul 90) pp 551-558

[Article by Yu. B. Mineyev, I. B. Volkov, G. A. Glukhov, and V. I. Larkina; UDC 581.521]

[Abstract] Various high- and low-apogee satellites have measured either energetic electrons or low-frequency electromagnetic emissions. Simultaneous measurements, however, are needed, because the interaction of particles and waves plays a key role in the development of magnetospheric processes during disturbances. In the work reported here, the researchers analyze simultaneous measurements made by the Interkosmos-19 satellite during the magnetospheric storm of 10-12 March

1979 ($D_{st}^{max} = -127$ nT). A semiconductor-based telescope and two gas-discharge counters were used to measure electrons with energies of E_e greater than or equal to 0.04 MeV and greater than or equal to 0.1 MeV. Electrons in the ranges of 0.3-0.6 MeV, 0.6-0.9 MeV, 0.9-1.2 MeV, and 1.2-2.0 MeV were also measured. (Satellite orbital inclination was approx. 74°; apogee, 1,000 km; perigee, 500 km; orbital period, 100 minutes.) The axes of the detectors were aimed roughly perpendicular to magnetic field lines of force. The magnetic and electrical field components were measured in five channels with center frequencies of 0.14 kHz, 0.45 kHz, 0.80 kHz, 4.65 kHz, and 15.0 kHz. The researchers found a region of intense LF emissions on the night side during the storm development phase. Those emissions appear to result in a precipitation of energetic electrons. During the development phase, the maximum in the emission spectrum shifts toward a lower frequency (140 Hz) and returns to 450-800 Hz afterwards. Figures 3, references 12: 9 Russian, 3 Western.

Dynamics of Multicomponent Ion Ring Current During Storm of 12-13 August 1985, From Results of Measurements Made by Gorizont and AMPTE/CCE Satellites

927Q0051G Moscow KOSMICHESKIYE
ISSLEDOVANIYA in Russian Vol 29 No 4, Jul-Aug 91
(manuscript received 18 Aug 90) pp 559-566

[Article by A. S. Kovtyukh, M. I. Panasyuk, N. A. Blasova, and E. N. Sosnovets; UDC 581.521]

[Abstract] A number of questions remain unclear as to ring current ionic composition, structure, and dynamics, and the researchers here feel that the wide variations observed in the ring current warrant simultaneous observation. They analyze the results of data obtained 12-13 August 1985 by two satellites—the Soviet Gorizont in geostationary orbit ($R = 6.6 R_E$) and the NASA/EAS AMPTE/CCE satellite in a highly elliptical orbit. The measurements made by the AMPTE/CCE vehicle were performed with the CHEM (charge-energy-mass) spectrometer, which has 32 equivalent logarithmic channels ($\Delta E/E$ approx. 0.1) covering a range of E/Q of roughly 0.3-315 keV/e, plus 10 high-energy channels in the range of 0.025-6 MeV. The measurements by the Gorizont satellites were performed with the PPD detector. Both satellites were near the geomagnetic equatorial plane during the measurements. The AMPTE/CCE vehicle measured pitch-angle distribution. Because the Gorizont did not rotate around its axis, it was able to measure particle flux in a direction along the plane of the geographic equator. The researchers here examined only particle flux with an equatorial pitch angle of approximately 90°. Comparison of the data from the two vehicles indicates that the H^+ spectra obtained in an E range of 60-120 keV are in good agreement for magnetically quiet periods, with their shape being close to exponential. During the storm of 12-13 August, the H^+ fluxes increased in the vicinity of the geostationary orbit. The data from both satellites indicates that the increase is

greater as the energy levels of the ions increase, with the spectra becoming harder and, in the low-energy regions, the exponential nature of the spectra becoming disrupted. The nature of the variations observed deep in the belts is markedly different. Also in agreement are the $[C,N,O]^{6+}$ data. The researchers demonstrate that the variations of the energy spectra of the ring current ions at $L > 5$ during the storm correspond to the local acceleration of ions of all energies, with preservation of the first and second adiabatic invariants. At the outer edge of the ring current, fluxes of particles with energies greater than or approximately equal to 60 keV/e grow with increasing intensity during a storm as ion energies rise and distance from the Earth observation point grows. Figures 4, references 12: 6 Russian, 6 Western.

Energy Spectra High-Energy Electrons and Positrons Below the Earth's Radiation Belt

927Q0051H Moscow KOSMICHESKIYE
ISSLEDOVANIYA in Russian Vol 29 No 4, Jul-Aug 91
(manuscript received 18 Jun 90) pp 567-575

[Article by S. A. Voronov, A. M. Galper, S. V. Koldashov, L. V. Maslennikov, V. V. Mikhaylov, and A. B. Popov; UDC 523.037:525.7]

[Abstract] The work reported here presents the results of measurements made of the energy spectra of electrons and positrons in the 10-200 MeV range with the Mariya magnetic spectrometer aboard the Salyut-7 station in 1985 and the Mir station in 1988 and 1989 in studies of ion spatial distribution. The spectra of the electrons and the positrons were found to be very close to power-law spectra of about E^{-2} above 8 MeV, which is in conflict with the existing estimates of electron flux intensity that are based on π - μ - e decay. In general, the data jibe with the assumption that the mechanism of formation of electron and positron fluxes below the radiation belt involves the decay of pions that come about in the interaction of cosmic rays and the Earth's atmosphere. Theoretical calculation indicate a spectrum shape that differs from a that of a power-law spectrum for low energies. The divergence stems from the fact that, at energies of less than 100 MeV, the calculations must take into account, first, the secondary interactions of the particles that are generated and, second, accurate profiles of the birth of charged pions in the pp -interaction, not to mention angular distributions of cosmic rays and the secondary particles that come about. A careful examination of the spectra of quasi-trapped and albedo electrons and positrons and the correlation of their fluxes demonstrates that there is no absolute congruence. To obtain proper particle spectra, one must regard the trapping of particles as a real field, and not a dipole magnetic field, and one must accurately factor in the effects of solar modulation. One must examine electron and positron drift in a real geomagnetic field and, on the basis of that, explain the longitudinal dependences of intensities and the variation of the charge ratio of positrons and electrons in various energy ranges. Figures 6, references 18: 16 Russian, 2 Western.

Interpretation of Electron Concentration Measurements Made by the Vertikal-4, -6, and -7 Rockets

927Q0051I Moscow KOSMICHESKIYE
ISSLEDOVANIYA in Russian Vol 29 No 4, Jul-Aug 91
(manuscript received 31 May 1990) pp 576-581

[Article by A. V. Pavlov; UDC 551.510.53]

[Abstract] Experimental measurements of N_e concentration are compared with theoretical calculations. The measurements were made with UHF dispersion interferometers mounted on the Vertikal-4, -6, and -7 rockets launched near Volgograd in October of 1976 and 1977 and November 1978, respectively. Solar activity was elevated when Vertikal-7 was launched. Theoretical results were a function of the model chosen for density distribution and atmospheric pressure. The best agreement was achieved with the MSIS-86 and DTM models for the launches during quiet periods, and with the MSIS-86 for the launch during the active solar period. The heights of h_1 and h_2 (for the northern and southern hemispheres, respectively) at which $[O^+] = [H^+]$ vary dramatically when the model for density distribution and atmospheric pressure is varied. N_e measurements are not in good agreement with calculations based on the IRI empirical model. Figures 2, references 15: 9 Russian, 6 Western.

Generation of ULF and VLF Emissions in Inhomogeneous Plasma in the Plasmapause Region

927Q0051J Moscow KOSMICHESKIYE
ISSLEDOVANIYA in Russian Vol 29 No 4, Jul-Aug 91
(manuscript received 18 Jun 90) pp 593-596

[Article by N. I. Izhovkina, V. I. Larkina; UDC 550.385.37]

[Abstract] During two phases of a 4 April 1979 substorm, Interkosmos-19 observed fluctuations in ULF and VLF emissions in a wide range of frequencies as it passed through inhomogeneous plasma at an altitude of about 1,000 km in the region of the plasmapause, the polar cusp, and the polar cap. Measurements were made of the electrical and magnetic components of the wave field at arbitrary frequencies of 140 Hz, 450 Hz, 800 Hz, 4650 Hz, and 15,000 Hz. The researchers were able to identify regions of the upper ionosphere in which electrostatic instability develops, but the absence of three-component measurements made it difficult to single out asymmetric electrostatic fluctuations from the data. The region of plasma instability was found at the boundary of the plasmasphere, where wide-band quasioleostatic emissions were observed. The instability has a threshold in terms of plasma density. Figures 1, references 4 (Russian).

Measurement of Magnetic Field Vector From Rotating Spacecraft

927Q0051K Moscow KOSMICHESKIYE
ISSLEDOVANIYA in Russian Vol 29 No 4, Jul-Aug 91
(manuscript received 11 Jul 90) pp 597-603

[Article by M. K. Trubetskoy, Ye. G. Yeroshenko, I. P. Lyannaya, A. A. Ruzmaykin, D. D. Sokolov, V. A. Styazhkin, and A. M. Shukurov; UDC 537.591]

[Abstract] Magnetic field measurements are generally performed with three-component magnetometers whose sensors are rigidly fixed to the spacecraft, which is often stabilized via rotation around a fixed axis. The magnetic field components that are perpendicular to the axis of rotation, however, are modulated by the harmonic component, and if they are to be converted to an immobile system of coordinates, the angular velocity of rotation ψ must be known, as well as the absolute orientation of the vehicle. Even a small error in the estimation of the angular velocity leads to a rapid growth in the error associated with the determination of the total angle of turn, which dramatically lowers the accuracy of the determination of the magnetic field. The researchers here advance a method of determining the magnetic field parameters measured from a spacecraft rotating with an unknown angular velocity around a fixed axis. The method is used to process magnetic measurements performed by Fobos-2, which carried the MAGMA and FGMM magnetometers and is accurate to 0.1 percent. Figures 3, references 3: 2 Russian, 1 Western.

Physical Properties of Phobos Rheolite

927Q0051L Moscow KOSMICHESKIYE
ISSLEDOVANIYA in Russian Vol 29 No 4, Jul-Aug 91
(manuscript received 15 Feb 90) pp 621-640

[Article by L. Ksanformaliti, V. Moroz, Space Research Institute, Moscow; S. Murchie, D. Britt, Geology Department, Brown University, Providence, R.I.; N. Goroshkova, Space Research Institute, Moscow; T. Duxbury, JPL, Pasadena, Calif.; B. Zhukov, Space Research Institute, Moscow; E. Khurt, Space Research Institute, GDR Academy of Sciences, Berlin; B. Murray, California Institute of Technology, Pasadena; G. Nikitin, Ye. Petrova, Space Research Institute, Moscow; C. Pieters, Geology Department, Brown University; A. Soufflot, Institute of Space Astrophysics, Orce, France; P. Fisher, J. Head, Geology Department, Brown University; UDC 535.24:523.43]

[Abstract] Preliminary results of two experiments involving remote sensing of Phobos regolith with the KRFM instrument carried by one of the Fobos spacecraft are reported: one involving spectrophotometry at 300-600 nm and the other involving radiometry at 6-50 μ m. The thermophysical characteristics of the regolith produce an average value of 2×10^{-3} cal/(cm²/deg/s^{1/2}), which is similar to that of the regolith of the Moon. The reflective properties of the Phobos regolith were largely heterogenous along the tracks that were studied. The

tracks covered longitudes 129-254°W, with latitudes from 8.5°N to 14.4°N, and longitudes 209-245°W, with latitudes 26-35°N. Track I went from the morning terminator to 1400 hr local solar time; track II went from 900 hr to roughly 1100 hr. The researchers tentatively conclude that along most segments of the tracks, unmodified carbonaceous chondrites are not the best model for Phobos regolith, primarily because the material has reflective properties that are not all similar to most meteorite models. In terms of optical properties, mafic rock with modified reflective characteristics appears to be the best model and matches the spectral properties of gray Phobos regolith. The reddish-gray and red regoliths may, in fact, have a composition very similar to that of the gray, but their reflective properties differ as a result of modification processes. The spectrophotometric similarity that Phobos has to C-type asteroids suggests that such modification processes may be common to small bodies of the solar system. The researchers also suggest that the reddish-gray and red regoliths could be mixtures of various materials like carbonaceous chondrites, optically modified dark mafic rock, and even modified Martian regolith and space dust. Figures 13, references 17: 4 Russian, 13 Western.

Estimating the Mass of Halley's Comet Dust Particles From PUMA Data

927Q0051M Moscow KOSMICHESKIYE
ISSLEDOVANIYA in Russian Vol 29 No 4, Jul-Aug 91
(manuscript received 14 Jun 90) pp 641-646

[Article by Ye. I. Yevlanov, O. F. Prilutskiy, and M. N. Fomenkova; UDC 523.031:523.44]

[Abstract] In the Halley's Comet encounter, the two Vega spacecraft used the PUMA-1 and -2 dust impact time-of-flight mass-spectrometers to make direct measurements of the elemental composition of the particles of the dust coma of the comet—the first instrument measuring more than 2,000 spectra and the second, more than 500. Although the relatively high speed at which the two spacecraft were traveling presented difficulties for certain measurements, it turned out to be very useful in the study of the dust particles, because the high-velocity impact of the particles against the solid targets in each instrument produced rather effective ionization of the gas cloud that was formed. The ion composition of the plasma was then measured with the time-of-flight method, in which the ratio of the mass of the ion to its charge was determined. Particle flux was also measured, by recording the number of impacts per second on the target. The work reported here involved estimates of the mass of the particles whose spectra were measured by the PUMA instruments. All the spectra measured by each instrument were broken down into groups based on values for the analog signals measured at the moment of particle impact. The absolute values of the mass for each group were determined by comparing the distribution recorded and the data from the SP-2 dust particle counter. The PUMA instruments measured the TG, AC, PM, and CA analog signals at the moment of impact, in

two response modes—H and L. Analysis of the data indicate that particle mass recorded by the PUMA-1 instrument fell in the range of 5×10^{-17} g to 5×10^{-12} g; the range for PUMA-2 was 2×10^{-16} g to 5×10^{-12} g. In terms of relationship of chemical composition to mass, the number of particles that contained H, C, N, O, Na, Mg, Al, Si, S, Ca, and Fe grows as the mass of the particles measured by PUMA-1 grows, from 1 percent for a particle mass of 10^{-16} g to 8 percent for a mass greater than 5×10^{-13} g. For PUMA-2, at a mass of less than 10^{-15} g, there were no particles that contained all of the elements listed above. When the mass was greater than 3×10^{-13} g, some 2 percent of the particles contained all the above elements. Figures 2, references 10: 7 Russian, 3 Western.

External Thermal Loads for Gear Installed on a Spacecraft

927Q0051N Moscow KOSMICHESKIYE
ISSLEDOVANIYA in Russian Vol 29 No 4, Jul-Aug 91
(manuscript received 31 May 90) pp 647-650

[Article by G. A. Bril; UDC 629.7]

[Abstract] In studying the accuracy associated with calculation of the thermal loads to which space-borne equipment is subjected, the researchers here base their analysis on an equation $Q_{\text{ext}} = Q_S + (Q_R + Q_E) + Q_{\text{ref}}$, in which total thermal load is equal to incident solar radiation, plus planetary radiation (reflected radiation and re-radiation), plus radiation from neighboring instruments and structures aboard the spacecraft. Their own technique for estimating the external thermal loads involves a planetary model that assumes the Earth to be a spherical body that emits and reflects radiation diffusely and that has an effective radius of $R = R_0 + H_a$, where $R_0 = 6,371$ km is the average radius of the Earth and $H_a = 12$ km is the upper boundary of the effectively radiating layer of the atmosphere. The model also assumes that planetary albedo is constant for the entire surface. The principal sources of error associated with the calculation of emissions from Earth are calculation technique and indeterminacy of albedo. Solar radiation absorption coefficient is also problematic, because thermal-regulation coatings degrade over time and vacuum-shield thermal insulation properties change. The researchers point out that the relative contribution of heat fluxes from Earth is maximum at the midpoint of a spherical spacecraft's traversal of the dayside of the Earth and approaches a value of half of the external thermal load if the spacecraft altitude is 300 km. The Earth's contribution to thermal load need not be taken into consideration at altitudes of 6,000 km or higher. Figures 2, references 5 (Russian).

Stability of Attitude-Control Systems in Conditions of Random Interruption of Controlling Influence

927Q0051O Moscow KOSMICHESKIYE
ISSLEDOVANIYA in Russian Vol 29 No 4, Jul-Aug 91
(manuscript received 25 Jul 90) pp 651-654

[Article by G. Ya. Ledenev; UDC 629]

[Abstract] During control of a spacecraft's attitude, the algorithm of formation of the controlling influence may be disrupted by the presence of interference in the attitude-control sensor signals. Such disruptions stem from the interruption of the relay control signal, which can lead to a loss of spacecraft stability. The researchers here demonstrate that if the mean value of the random functions R_+ and R_- ("+" indicates angular acceleration, and "-" indicates diminishing angular velocity) are known a priori, the value for the angular velocity of the spacecraft at which stable control is achieved can be found. If the random functions change during the control process, stability may be achieved if the inequality $|\gamma_0| > |\gamma|$ is fulfilled on an arbitrary arc of the phase trajectory consisting of the finite number q ($q = 1, 2, 3, \dots$) of sequential arcs, with γ_0 and γ the angular velocity values at the beginning of the first arc and the end of the q -th arc. Figures 1, references 2 (Russian).

Statistical Distributions of Cosmic Gamma Bursts Registered in Soviet-French Experiments SIGNE-2MS (Venera-13, 14) and APEX (Phobos-2)

927Q0052A Moscow *ASTRONOMICHESKIY ZHURNAL in Russian* Vol 68 No 4, Jul-Aug 91 (manuscript received 29 Nov 90) pp 742-748

[Article by I. G. Mitrofanov, V. Sh. Dolidze, A. A. Kozlenkov, R. N. Kucheroval, A. S. Pozanenko, A. M. Chernenko, C. Barat, J.-L. Atteia, E. Jourdain, M. Niel and G. Vedrenne, Space Research Institute, USSR Academy of Sciences; Center for Study of Cosmic Radiation, Toulouse, France; UDC 52-732]

[Abstract] A statistical study was made of the distribution "frequency of occurrence of cosmic gamma bursts - maximal counting rate in detector" on the basis of data from the Soviet-French SIGNE-2MS experiments on the Venera-13 and Venera-14 interplanetary stations and APEX experiments on the Phobos-2 interplanetary station. An estimate of the mean parameter $\mu_{\max} = 0.412 \pm 0.019$ was obtained. This and other considerations suggest that the sources of gamma bursts probably have a nonuniform spatial distribution and/or a nonuniform luminosity function and/or a nonuniform mean frequency of generation of bursts. These nonuniformities may be related to the joint contribution to the generation of bursts made by both relatively younger neutron stars from the part of the spiral arm adjacent to the sun and older neutron stars from the neighborhood of the galactic disk subsystem closest to the sun. If this is true it must be expected that with accumulation of the number of registered gamma bursts it will be confirmed that more intensive sources actually have harder spectra and are grouped in directions along the axis of the nearest spiral arm, whereas events of lesser intensity have softer spectra and their distribution over the celestial sphere is isotropic or even is concentrated toward the galactic plane. Figures 3; references 16: 1 Russian, 15 Western.

Formation of Planetary Systems in Course of Evolution of Close Binaries

927Q0052B Moscow *ASTRONOMICHESKIY ZHURNAL in Russian* Vol 68 No 4, Jul-Aug 91 (manuscript received 3 Oct 90) pp 837-842

[Article by A. V. Tutukov, Astronomy Institute, USSR Academy of Sciences; UDC 524.387-54]

[Abstract] The discovery of disklike dust envelopes around a high percentage of bright A-stars suggests the widespread occurrence of planetary systems, motivating a reexamination of modern scenarios of formation of planetary systems around individual stars and products of merging of close binaries. These scenarios are briefly described and estimates of the frequencies of realization of different scenarios in the Galaxy are given. An analysis of such scenarios indicates that the modern theory of early stages in the evolution of individual stars and the theory of evolution of close binaries suggest several possible variants of the genesis of planetary systems. The ordinary scenario dating back to Kant and Laplace remains the most probable: formation of planets around individual stars from gas-dust clouds with excessive angular momentum. The merging of components of close binaries under the influence of the magnetic star wind, the radiation of gravity waves or the destruction of one of the components leads to the appearance of old individual stars with a great excess of angular momentum. The evolution of such stars also may lead to the appearance of a circumstellar gas-dust disk with probable subsequent formation of a planetary system in it. References 14: 6 Russian, 8 Western.

Influence of Relativistic Effects on Results of Satellite Geodynamics, Geodesy and Navigation. Research Methods

927Q0052C Moscow *ASTRONOMICHESKIY ZHURNAL in Russian* Vol 68 No 4, Jul-Aug 91 (manuscript received 17 Jul 90) pp 872-879

[Article by N. V. Yemelyanov and A. V. Krivov, State Astronomical Institute imeni P. K. Shternberg; Leningrad State University; UDC 521.176]

[Abstract] A number of methods are now available for introducing relativistic corrections into algorithms for solving problems related to artificial earth satellites, but there has still been no systematic research on the qualitative and quantitative character of the influence of the effects of the general theory of relativity in the context of specific schemes for the processing of satellite information. Despite published research on this subject, there are no estimates of the overall relativistic effect, nor has there been virtually any study of the sensitivity of real algorithms for the solution of satellite problems to allowance for, or, vice versa, negative consequences of failure to take relativistic effects into account. An attempt has been made to remedy these shortcomings by means of simulation of the motion of artificial earth satellites, real satellite observations and their processing within the

framework of a model problem. This first part of the study contains a formulation of the problem, description of a scheme for studying general theory of relativity corrections, the adopted physical model and the program package developed for such research. The results and conclusions will be set forth in the second part. References 19: 10 Russian, 9 Western.

Research on Response of System for Tracking Motion of Artificial Earth Satellite

927Q0063A Moscow AVTOMATIKA I
TELEMEKHANIKA in Russian No 5, May 91
(manuscript received 14 Mar 90) pp 80-86

[Article by V. A. Bratchikov and A. I. Nazarenko, doctor of technical sciences]

[Abstract] A monitorable object, measuring systems and data processing point form an artificial earth satellite tracking system. An analytic method is proposed for determining the accuracy characteristics for such a system operating in a steady mode and also the transient processes arising in such a system when it is acted upon by different kinds of perturbations. The necessary initial equations are found by linearizing the equations of satellite motion and by making measurements in the neighborhood of the reference trajectory. These equations have the form: $dx/dt = Ax + Bw$, $z = Hx + \theta$, where $x(t)$ and $z(t)$ are the deviations of the true orbital parameters from the computed values; A , B , H are matrices; $w(t)$ and $\theta(t)$ are perturbations (errors) which characterize random processes with known correlation functions. The problem is to determine the statistical characteristics (correlation matrix) of the vector of state and to investigate the influence of perturbations having a standard form on tracking system errors. A numerical solution is not difficult, but the multidimensionality and diversity of possible values of the parameters makes such an approach inefficient (analytical research is desirable). Applying a number of simplifying assumptions, the feasibility and desirability of such an approach is demonstrated. The solution of the problem of determining the values of the vector of state which are optimal in accuracy essentially involves use of a Kalman-Bucy filter. The results of simulation are presented. Figures 2; references: 4 Russian.

Special Features of Astroclimate of Observation Point in Bolivia

927Q0057A Kiev KINEMATIKA I FIZIKA
NEBESNYKH TEL in Russian Vol 7 No 6, Nov-Dec 91
(manuscript received 9 Jan 91) pp 71-73

[Article by G. A. Alekseyeva, A. A. Arkharov, V. D. Galkin and V. V. Novikov; Main Astronomical Observatory, USSR Academy of Sciences, Pulkovo; UDC 520.16]

[Abstract] An astrophysical detachment of the Main Astronomical Observatory, USSR Academy of Sciences, worked

at the Bolivian-Soviet Observatory near Tarija (21°35'S, 64°40'W) during the period August 1987-September 1989. Spectrophotometric observations of stars were made in the visible and near-IR spectral ranges (310-1100 nm). Observations and processing were carried out by the fundamental spectrophotometry method. Data also were obtained on some astroclimatic parameters of the observation point: number of clear nights, their distribution by seasons, maximal and minimal atmospheric extinction coefficients and dependence of atmospheric moisture content on season. There were 146 clear nights during the two years, of which 114 were during autumn-winter and 32 during spring-summer. Winter and summer differ sharply with respect to number of clear nights and level and stability of extinction. The observation point has an average astroclimate. The extinction coefficient values for a wavelength 550 nm vary in a range 0.13-0.46^m. The quantity of water vapor varies from 5 to 30 mm of precipitable water and even in winter attains 15-20 mm. There is a sharp increase in the extinction coefficient with an increase in the quantity of atmospheric moisture. References: 4 Russian.

Large-Scale Inhomogeneities in Universe and Spectra of Fluctuations

927Q0053A Moscow PISMA V
ASTRONOMICHESKIY ZHURNAL in Russian Vol 17
No 8, Aug 91 (manuscript received 15 Jan 91)
pp 659-670

[Article by B. I. Hnatyk, V. N. Lukash and B. S. Novosyadlyy, Institute of Applied Problems in Mechanics and Mathematics, Ukrainian Academy of Sciences, Lvov; Astrospace Center, Physics Institute, USSR Academy of Sciences, Moscow; Astronomical Observatory, Lvov University; UDC 524.8]

[Abstract] The requirements on the spectrum of fluctuations of the density of matter are analyzed with respect to correspondence between the predicted and observed characteristics of macroscale structure of the universe. Existing cosmological models based on a gravitational increase in random Gaussian adiabatic density fluctuations provide no explanations for the totality of observational data on the macroscale structure of the universe. The ad hoc CDM + X spectrum proposed by J. M. Bardeen, et al. (ASTROPHYS. J., Vol 321, p 28, 1987), which was to have solved this problem, gives excessively great temperature fluctuations of relict radiation at scales 6°. A CDM + Z spectrum is proposed in this article which is free of this shortcoming and which at the same time is the most favorable for the appearance of large-scale fluxes and phenomena of the GA (Great Attractor) type. The CDM + Z spectrum, assuming a Gaussian random field of primary fluctuations, therefore explains the correlation function of galaxies rich in clusters and the relation between them, large-scale bulk motions of galaxies and existence of infrequent high surges and is consistent with known restrictions on the anisotropy of temperature of relict radiation. A decrease in the upper limit of the "Kholod" experiment at scales about 2° by a factor of 2 already would make it possible to register such a spectrum. Figures 5; 34 references: 6 Russian, 28 Western.

Models of Lunar Structure and Origin

927Q0054A Moscow *ASTRONOMICHESKIY VESTNIK in Russian* Vol 25 No 4, Jul-Aug 91 (manuscript received 21 Mar 91) pp 408-421

[Article by Ye. L. Ruskol, Earth Physics Institute imeni O. Yu. Shmidt; UDC 523.34]

[Abstract] Fundamental data on lunar structure obtained from space and surface research are briefly summarized. The early thermal history and origin of the moon for the time being remain inadequately known. Two extreme variants of a model of formation of the moon from a circumterrestrial disk are compared. In one of them the disk arose as a result of the impact of a large planet into the mantle of the growing Earth; in the other the disk was gradually replenished by matter from the protoplanetary cloud. Both models of lunar origin require further quantitative investigation, also including the entire history of the Earth, especially for the case of a catastrophic formation of the disk. A table outlines the conditions pertinent to scenarios of lunar formation for the two variants: megaimpact and coaccretion. The two variants are compared with respect to: lunar mass, angular momentum of moon in orbit; low Fe content in moon; deficit of volatiles in moon; trace elements and other chemical limitations; high initial temperatures; orbital evolution. Particular attention is given to the collision hypothesis outlined by D. J. Stevenson in *ANN. REV. EARTH. PLANET. SCI.*, Vol 15, pp 271-315, 1987. Although in its modern form the megaimpact hypothesis has much to support it, there are many arguments against it (Stevenson feels that the Uranian satellite system is the best candidate for formation by means of megaimpact). Figures 9; references 16: 4 Russian, 12 Western.

Lunar Geological Structure

927Q0054B Moscow *ASTRONOMICHESKIY VESTNIK in Russian* Vol 25 No 4, Jul-Aug 91 (manuscript received 21 Mar 91) pp 422-430

[Article by A. L. Sukhanov; Geological Institute, USSR Academy of Sciences; UDC 523.34]

[Abstract] A brief overall summary of information on the principal structures on the lunar surface (continents, maria, basins, impact craters and volcanic formations), on their deep structure and on the regolith covering them is given. The morphological features of structures, making it possible to establish their genesis and age and

to construct a stratigraphic scale from the time of consolidation of the lunar crust to the present time, are described. This review reveals that the relative role of impact and volcanic processes on the moon and the characteristics of impact and endogenous structures have been rather well established, the structure of the lunar mantle has been clarified in its general features and a chronological scale of stages in formation of its surface has been constructed. However, there are still no good photographs of the polar regions and extensive territories on the far side, especially to the west of the Mare Orientalis. A geochemical survey from orbit reveals only the general character of surface rocks and has been made only in a relatively narrow zone along the Apollo trajectories. Variations in thickness of the crust, inhomogeneities in its structure and especially in mantle structure for the most part are subjects of speculation and require additional seismic and gravitational research. The composition and absolute ages of some types of lunar rocks remain untested. The scale of events more ancient than 3.9 billion years requires further calibration. The composition and origin of such formations on the lunar surface as the Cayley formation still remain unclear. Figures 2; references 9: 4 Russian, 5 Western.

Lunar Selenodesy and Cartography

927Q0054C Moscow *ASTRONOMICHESKIY VESTNIK in Russian* Vol 25 No 4, Jul-Aug 91 (manuscript received 21 Mar 91) pp 431-438

[Article by V. S. Kislyuk, Main Astronomical Observatory, Ukrainian Academy of Sciences; UDC 523.34]

[Abstract] The availability of new data on the lunar gravity field has made it necessary to rethink some prevailing concepts in selenodesy. This is a review of recent research, Soviet and Western, on the gravity field, geometric and dynamic figures of the moon. Among the most important problems considered are the referencing of a fundamental selenodetic coordinate system in the lunar body and laying out of a network of control points on the lunar surface. The present-day status of these matters is discussed. Existing selenodetic reference systems and catalogues are discussed. Generalized selenodetic and selenodynamic parameters are given, as well as information on the principal studies relating to mapping of the lunar surface, including a brief description of modern maps, atlases and globes, whose accuracy is governed by the accuracy of selenodetic control networks. The shortcomings in each of these fields of research are outlined and some proposals are made on work which should be undertaken. References 20: 11 Russian, 9 Western.

Two-Color Photometry of Pluto

927Q0054D Moscow *ASTRONOMICHESKIY VESTNIK in Russian* Vol 25 No 4, Jul-Aug 91
(manuscript received 15 Jan 91) pp 439-441

[Article by R. I. Kiladze and V. Dzh. Kukhianidze, Abastumani Astrophysical Observatory; UDC 523.482]

[Abstract] During 1986-1990 the 125-cm AZT-11 telescope at the Abastumani Astrophysical Observatory, Georgian Academy of Sciences, was used in photoelectric observations of Pluto in B and V colors. The results are cited in Table 1 which gives: UT, Julian day, brightness of Pluto in two colors, star magnitudes of planet reduced to the mean opposition and the corresponding phases. From the discovery of Pluto to the early 1980's its albedo gradually decreased. During the last decade the albedo became virtually constant, and in 1990 there was even a small increase in albedo in the color B. Recently there also has been a systematic increase in the color index of the planet and its value exhibited no appreciable correlation with phase. In 1988 there was a maximum for the color index, after which it began to decrease. An extremely significant decrease occurred in 1990. Table 2 reflects these findings, giving observation epoch, mean color index and references to the literature. The color index attained a maximum in 1988. Accordingly, albedo attained a minimum prior to the planet passing through perihelion. It is postulated that these phenomena are related to the gradual falling of a circumplanetary swarm of particles onto Pluto. Now, due to approach of the planet to the plane of the ecliptic and renewal of the process of interception of interplanetary matter there is a recurrent increase in swarm density, which in the future should result in an increase in the albedo of Pluto and a decrease in its color index. References 8: 2 Russian, 6 Western.

Iron and Chromium Absorption Bands in Spectra of Terrestrial Pyroxenes: Application to Remote Mineralogical Analysis of Surface of Asteroids

927Q0054E Moscow *ASTRONOMICHESKIY VESTNIK in Russian* Vol 25 No 4, Jul-Aug 91
(manuscript received 6 Sep 90) pp 442-452

[Article by D. I. Shestopalov, L. F. Golubeva, M. N. Tarap and V. M. Khomenko, Shemakha Astrophysical Observatory, Azerbaijan Academy of Sciences; Geochemistry and Physics of Minerals Institute, Ukrainian Academy of Sciences; UDC 523.4]

[Abstract] It is shown that research on the characteristics of absorption bands in the visible spectral region gives a more complete "spectral image" of minerals and can serve as a basis for a mineralogical interpretation of the spectra of asteroids. Spectrophotometry of pyroxenes containing Fe and Cr during the cooling of samples from room to nitrogen temperature revealed a short-wave shift of the center of the Fe^{2+} absorption band at $0.95 \mu\text{m}$ and absence of the same for the Y- and U-absorption bands of Cr^{3+} . The possibility of remote diagnosis of the compositions of pyroxenes from the position of the center of the Fe^{2+} absorption band at $0.505 \mu\text{m}$ was demonstrated. Arguments are cited in support of systematic differences in the compositions of pyroxenes of S-asteroids and light stony meteorites (achondrites and ordinary chondrites). A comparison of the parameters of the crystalline field for the absorption bands in the regions 0.44 and $0.64 \mu\text{m}$, discovered in the spectra of some light asteroids, with similar data for the Y- and U-bands of Cr^{3+} confirmed the existence of pyroxenes containing Cr in the asteroid belt. Figures 7; references 17: 10 Russian, 7 Western.

'Bios' CELSS Experiments in Support of Manned Spaceflight Recounted

927Q0061A Moscow KOMSOMOLSKAYA PRAVDA
in Russian 15 Jan 92 p 4

[Article by V. Nelyubin: "Three Flights to Mars. Soviet 'Cosmonauts' Made Them in the Early 1960's Without Leaving the Earth"]

[Text] Lilya Bugreyeva for the first time during her married life met the New Year, 1978, without Nikolay. To the incessant questions of friends and acquaintances she answered sparingly: he has gone off on a long assignment. Although completely different words wanted to burst outward. She terribly wanted to share with at least someone her secret and her pride in her husband, but Lilya was very strictly forbidden to spread the word about his new work. And even Marinka, four years old, did not know that her daddy, Nikolay Bugreyev, an engineer of the Physics Institute, Siberian Department, USSR Academy of Sciences, had not just gone off anywhere, but to... Mars.

Strictly speaking, Nikolay Bugreyev actually rode away, or even walked away, but did not fly away, to his secret assignment. The fact is that his "rocket" did not undergo tests in space, but in his own Krasnoyarsk Academic City, true, underground, in a special bunker where a mockup of the future space station was situated in which three test subjects, in full isolation from the Earth, were to live for six months. Approximately that much time, according to the calculations of scientists, is necessary for the flight of an interplanetary ship to Mars.

Lilya saw the "Bios-3," as this secret station was named, with her own eyes only quite recently, on New Year's eve, when the wives were allowed to meet with their husband—"cosmonauts." In comparison with the wife of Shtirlits she nevertheless had some advantages: in addition to looking at one another through a window they were allowed to talk a little to one another by telephone. In the basement of the institute building, to which admission is granted only by special passes, there was something which was a cross between the "Nautilus" of Captain Nemo as it is usually portrayed in children's books and a gigantic safe. The Noah's ark, welded from stainless steel plates, was inwardly divided into four equal compartments. In two, to her amazement, she discovered a real garden in which beneath a nonsetting electric sun wheat produced its ears and vegetables turned green. In the third compartment there were some intricate assemblies: cultivators of Chlorella algae, which, as they explained to her later, together with the "garden" regenerated oxygen and water in the "Bios." Nikolay, with two colleagues, the physician Nikolay Petrov and the agronomist Mariya Shilenko, lived in the fourth compartment, where in 30 square meters there were three tiny sleeping compartments, like in railroad cars, but with one trestle bed, kitchen, toilet, shower, control panel and small workshop.

The hatches of the locks were tightly battened down and neither sounds nor air penetrated into the "Bios" from the outside. The "cosmonauts" were connected to the Earth by the umbilical cord of an electric cable which, by the intent of the designers, should replace solar cells. But the principal evidence that the experiment was "tied" to the Earth was not the cable, and not the telephone connecting the test subjects with the outside world, and not even the television set standing next to one of the windows, but a wax seal with which the main entrance was sealed.

An announcer, from the screen of the household TV, began to read a New Year's address to the Soviet people. He spoke of the arrival of the midpoint in the Ninth Five-Year Plan, about the recent 24th CPSU Congress and adoption of the Peace Program and noted that a society of well-developed socialism had been constructed in the USSR. As if all this was now far away, Lilya switched her thoughts to her "Martian" traveller, who at that hour sat with his friends in his stainless steel "Nautilus" with a little cup of tea (alcoholic beverages were very strictly forbidden to the cosmonauts), and the same as Lilya allowed the words of the announcer communicated from the Earth through the loudspeaker to slip past his ears and thought about his wife and Marinka.

The starting of the "Bios" biography can be illustrated by an anecdote. But precisely this is the way it all took place.

On one beautiful day, soon after the flight of Yuriy Gagarin into space, on the recommendation of Academician Leonid Vasilyevich Kirenskiy, two young Siberian scientists—Ivan Terskov and Iosif Gitelzon, were admitted to see the then supersecret Sergey Pavlovich Korolev. From the threshold they took the bull by the horns and extended to the General Designer a test tube with a transparent fluid:

"Try it! We regenerated this water from human urine by means of Chlorella!"

Korolev, not being a devotee of the urine therapy which is now in vogue, refused from disgust, but listened to his guests with interest and after asking a great many questions, thanked them for developing a biological system which in a closed space was capable of accomplishing the natural cycling of water and oxygen.

"At that time it seemed to us, in general, young people, that this problem was not all that complex," recalls one of the "fathers" of the "Bios," Genrikh Mikhaylovich Lisovskiy, doctor of biological sciences. We figured more or less as follows. There is a remarkable alga, Chlorella, which multiplies rapidly, is simple and is rich in protein. The very first experiments using it for the regeneration of water and oxygen gave fairly good results. Another step and the artificial biosphere would be ready. But it was still a long, long way to go prior to the development of a balanced biological system in which man could live comfortably for a long time independently of the Earth.

The "Bios-1" was already launched a couple of years from the time of the meeting with Korolev at Krasnoyarsk. Then in the early 1960's a first experiment was carried out during which man remained for several days in a cocoon of vinyl plastic with a volume of 12 cubic meters alone with *Chlorella* and with a skimpy, for several hours, reserve of drinking water and oxygen.

By that time the Siberians had raised the intensity of *Chlorella* cultivation to such a level that normal water and gas metabolism of one man was ensured by only 18-20 liters of algae, a dark green fluid swarming with tiny bodies of unicellular *Chlorella* invisible to the naked eye. When viewed from above the biological regenerator resembled a daisy. Around the luminescent "button" of lamps with reflectors were eight vertically positioned three-dimensional "lobes," each with an area of one square meter, filled with *Chlorella*. The fluid, saturated with algae, was pumped along these lobes toward the air, the carbon dioxide was absorbed and oxygen was released. And after the addition of salts to it the condensate became drinking water.

It took a long time to select the first "cosmonaut" for "Bios-1." There were many who wished to be the first. Among the representatives of the fairer sex Tereshkova was outside the competition. No, this was not the famed Valentina Tereshkova, but another with the same last name (this coincidence was not the last consideration), Galina Tereshkova, a specialist at the institute. But as in space, the first to staff the "Bios" were males. While himself not wishing to take away the honor of being the first from among the numerous candidates, one of the directors of the project, Iosif Isayevich Gitelzon, now director of the Biophysics Institute, Siberian Department, Russian Academy of Sciences, an academician, but then a 35-year old doctor of medical sciences, terribly concerned about the health of the first test subjects, several days prior to the "Bios-1" launching illegally decided to encase himself in his "offspring." After asking a colleague to stay after work for a while, he entered the sealed cabin "for an hour or so" and remained there until morning.

Nikolay Bugreyev on that day in the "Bios-3" phytotron put things into order in what in the common speech of the test subjects was called the "garden"; it was his turn. They worked alone, in a mechanical way going about their agronomic duties during a week of "flight." His mind was busy with something else: Nikolay again and again mentally reviewed the meeting which he would soon have with his wife and little daughter, relishing every little detail of the impending rendezvous. Distracted by this diversion, he did not note that he had overstepped some ill-defined boundary between the real and fantasized. But that some malfunction had occurred in what by personal determination was his iron psyche he understood very clearly at that instant when the flashes on the "Bios" casing were transformed into a quiet summer sunset. Into an ordinary July sunset which in the "Bios," hidden deep beneath the ground, and especially in the phytotron, where the bright lamps never

go out during the long months of the experiment, even for a minute, simply could not be. Precisely then did he realize that he was worn out and yearned longingly for his little daughter.

He recalled 9 September 1968. On that day he and the team for the first time were handed a cutting torch and they began to "cut out" the first parts for the future "spaceship." He arrived at the institute in 1966 when the *Chlorella* era had almost come to naught. The love of scientists for the once-popular alga had cooled. It dealt with the regeneration of water and air rather successfully, but things did not work out with the preparation of food from it (this was the next step in creating a fully integrated closed biological system). Strictly speaking, a nutritious and harmless food could be prepared rather rapidly from protein-rich *Chlorella*, but the consumption of this "delicacy" with its ineradicable swampy odor and unusually repulsive taste was beyond the tolerance of even the most unparticular "astronaut" candidates.

Most scientists in the entire world by the mid-1960's had ceased to work on developing artificial biospheres and had switched to the improvement of chemical regenerators, which still are used on spaceships and orbital stations. It was decided to leave to future generations the development of biological systems supporting man's vital functions in isolation from the Earth's living nature, regarding such research to be a matter of the distant future. But precisely in these years at Krasnoyarsk they began to construct the "Bios-3," which should, according to the intentions of its creators, Ivan Terskov, Iosif Gitelzon, Genrikh Lisovskiy, Fedor Sidko and Boris Kovrov, bring together into an integrated biological system algae, higher plants and man. And into a system which should not be simply life-sustaining, but also self-developing.

Today, at the ending of the sixth month of the experiment, it was possible to assert boldly that they could make such a system a reality. During the entire time of their "flight" to Mars in the "Bios" there was only one insignificant thing which went wrong: the electric motor pumping water into the phytotron gave out. The malfunction was eliminated in several hours. But the biological part of the system worked like a clock, easily digesting all the human "wastes," transforming them into very pure water and air, even by terrestrial standards.

Nikolay went into the kitchen. He was on duty, but in the "Bios-3" the watch was kept around-the-clock and every day even the smallest details concerning the course of the experiment were entered in the log. Mariya Shilenko read a detective story, washing down this "spiritual food" with a little tea and rolls freshly baked from the wheat harvested the day before. In the space "garden" the hard work of harvesting took place each seven-nine days; both the wheat and vegetables were set out in the phytotron in such a way that in the "Bios" agricultural plots three seasons of the year seemed to be present simultaneously.

Hardy, space varieties were developed specially for the "Bios-3." They say that the wheat grown there was squatty and almost without long stems. (Where would one put straw in space? To burn it would mean to consume the scarce oxygen. It was impossible to eject anything from the ship under the conditions of the "game" other than dehydrated excrement. All the rest was put to use). For this it was necessary to cross dwarf Mexican wheat with Siberian "Skala" wheat. In the phytotron the new variety gave six crops a year and each time the test subjects harvested from the "space" field 120-130 centners per hectare, scaled to terrestrial measurements.

Already the first experiment, carried out in "Bios-3" in the winter of 1972-1973, became a scientific sensation. True, of a closed type. A Noah's ark for earthlings, allowing departure for distant space flight or setting down on one of the planets of the solar system, was ready in the rough. The specific wishes of the space "generals" also were taken into account by the Siberians. At one time there was rather serious preparation for establishing a Soviet permanently operating scientific research station on the moon. Funds were allocated for this project of the century and assignments were given to scientists in different fields of specialization. The "Bios-3" also was adapted for a lunar assignment. And Genrikh Mikhaylovich Lisovskiy, together with the graduate student Sofia Ushakova, in the early 1970's even received an Author's Certificate for a method for cultivating plants on the moon.

Then a second multimonth "flight" was carried out, and then a third: in 1976-1977 and 1983-1984. Altogether the test subjects spent two and one-half years in the "Bios-3."

By the mid-1980's the "Bios-3" was ready to learn to fly really, not by simulation. But the Siberian space "Nautilus" was in the same position as the "uncatchable Joe," who simply no one could catch. And today the "Bios" program, for which there are no equivalents elsewhere in the world (specialists assert that even the Americans with their generous financing and ambitions will not attain the level of the "Bios-3" model of the middle of the 1980's even by the end of the century) is quietly passing away from financial dystrophy. The problems involved in acquiring sausage have urgently shoved concern about science into the background. And those 500 000 rubles which were allocated in 1992 for the organization of further research will scarcely suffice even at today's prices for reconstruction of the illumination system,

which has become worn out and obsolescent during the years of the experiments. And indeed, the "Bios-3," marking its 20th anniversary, is all in need of overhaul. With things as they now prevail this process may be dragged out over a 10-year period. And the fact that an International Scientific Center was recently established on the basis of the "Bios" program says not so much about still another space program from which the "secret" label has been removed as about the calamitous state of Soviet science. Along these lines one of the directors of the "Bios-3" program, not without irony, noted:

"We are now attempting to flirt with everyone."

And there are more than a few wishing to flirt a little with our science, "a bride without a dowry." During recent months visits were made to Krasnoyarsk not only by Americans, but also by Germans and Japanese, unanimously recognizing the priority of the Siberian developers of closed biological systems. But despite this, the foreign guests have recently been viewing our space solvency extremely skeptically. It is not by chance that a representative of the Japanese National Space Agency, to the question of the Siberians whether by at least the beginning of the 21st century there would be a research base of earthlings on the moon, gave a "rowdy" response:

"I do not know whether by that time the Americans will be settled there, but we, for sure, will be on the moon!"

As you see, we no longer are taken into account.

Nikolay Bugreyev very rightfully can make a claim to a place in the Guinness Book of Records. As of today he is the indisputable holder of the record for the time spent in an artificial biosphere. After participation in all three "Bios-3" experiments this time is reckoned at 13 months.

Even today he is not parting from his underground "spaceship": he patches and repatches the worn and torn stainless steel interior of the "Bios." He jokes: "I gave birth to it and I will also kill it!" From the Martian odysseys have remained recollections and the threadbare "Moskvichonok" purchased ten years ago for "space" assignments, awards and long-service increments. "For those times they paid us fairly well."

So what's the outcome? From the beginning of that most memorable first flight Nikolay has not smoked and finds diversion in gardening.

NPO Energiya Project for Orbital Solar Reflectors

927Q0038 Moscow KRASNAYA ZVEZDA in Russian
13 Dec 91 p 4

[Article by M. Rebrov, under the rubric "New Projects": "The Sun Shines at Night"; first paragraph is KRASNAYA ZVEZDA introduction]

[Text] A sparkling, silver, flexible, elastic, very thin "mirror" covered the wall of the enormous hall. More precisely, a mirror film. At a distance stood a small structure that resembled a cylinder mounted on the frustum of a cone. In it was the "secret."

They say that an idea spoken aloud no longer belongs to only the person who spoke it. It becomes the property of everyone who heard it. That folk wisdom came back to me at a meeting with the technical management of the consortium Kosmicheskaya Regata—Prof. V. Syromyatnikov and N. Sevastyanov. It had to do with the Znamya Project, an unusual, multilevel project that holds out very tempting prospects—the use of space vehicles of special designs for lighting the surface of Earth.

A well-known space firm, the Energiya NPO (scientific production association), is implementing the project in collaboration with a number of design bureaus and production and science centers. But the idea of using a "sunbeam" for our terrestrial needs belongs to engineer V. Cherenkov (the author of these lines had occasion to write about it a quarter century ago).

There is a joke that goes, "The sun was created to save electrical power in the daytime." But why, strictly speaking, only in the daytime? If you calculate how much electricity is used at night, you'll get an enormous figure, one that is measured not only in kilowatts, but also in rubles. A sunbeam reflected by a "space mirror" can rush toward Earth and light cities and residential and industrial regions any given geographic "point." It can do its good deed in the northern latitudes during the polar night. But imagine how important it would be to have good illumination when dealing with natural disasters or when performing search-and-rescue operations at night.

The economic impact from space reflectors could be very, very great. After all, the lengthening of the solar day could facilitate an increase in the productivity of agriculture and the saving of resources. And all that with ecological cleanness. It was no accident that that part of the Znamya Project received the name "New Light."

The meeting with designers, scientists, and economists (the project envisages the commercial use of space illumination systems) "highlighted" not only the qualitative, but also the quantitative picture of the plan. Imagine a 200-meter mirror reflector that has been lifted to an altitude of 1,000 km. The light reflected from it will cast on Earth a sunbeam 10 km in diameter. As a result, on a cloudless night the illumination from such a reflector will be equal to 30 lux. That is comparable in

brightness to 300 so-called full moons. In other words, with such illumination, one could read a newspaper or take pictures without a "flash."

An experiment conducted during the race of space sailcraft to Mars (KRASNAYA ZVEZDA wrote about that project on 6 December of this year) will be the first step in the direction of the implementation of "New Light." The profile for performing the tests is as follows: The space sailcraft in stowed form will be taken on board a Progress-type cargo supply craft. After the cargo craft has executed its basic program—the delivery of cargo and fuel to the Mir orbital station—the cosmonauts, by way of the transfer hatch of the docking assembly, will assemble a folded model of a sail that is 25 meters in diameter and is made of a thin, mirror film. After the Progress undocks and departs the station, a command will be given to open the disk film....

Thus, the Znamya Project includes a series of tests, studies, and experiments: a solar sail in orbit, a space regatta, and "New Light."

"For now, we are only on the beginning of the path," Prof. V. Syromyatnikov said in concluding the conversation. "Money is needed to implement larger-scale plans. Queen Isabella generously gave it to Christopher Columbus. We are counting on space and general technical firms—domestic and foreign—to participate in our programs, as well as on individuals and on the companies that are willing to pay us for advertising their 'names'...."

Yes, big projects require big spending. In that regard, "New Light" is no exception. But it also promises a large return. So it will, in fact, be worth the effort.

Here at the end of this report, I want to return again to the authorship of the plan. You would agree that an idea is merely an idea. Even if it's surprising, original, and appealing, it still has no "material form." As Academician A. N. Krylov said, "in any practical matter, the idea accounts for 2-5 percent, while the remaining 95-98 percent consists in the execution." We would hope that the execution of "New Light" will be on par with the times.

Use of On-board Television Survey of Phobos for Obtaining Navigational Information

927Q0055A Moscow IZVESTIYA AKADEMII NAUK
SSSR: TEKHNIЧЕСКАЯ KIBERNETIKA
in Russian No 4, Jul-Aug 91 (manuscript received
13 Jun 89, after revision 11 Jun 90) pp 137-146

[Article by N. A. Demchuk, N. M. Ivanov and V. S. Polyakov; UDC 629.7.015]

[Abstract] The problems involved in developing a method and devices for the automated processing of an

image for navigational purposes are investigated. The navigational information obtained from such an image includes the angular coordinates of the center of mass of Phobos in some base inertial coordinate system. The algorithm for the processing of navigational images provides for obtaining the angular coordinates of the center initially in a television coordinate system whose axes are referenced to the axes of the optical system of the on-board television camera. Computation of the matrix for transformation from the television to the base coordinate system is a separate problem and is solved using telemetric data from the solar sensors during the survey and the results of calibrations of the on-board television system for the purpose of referencing of its axes to the axes of the automatic interplanetary station and insofar as possible, exclusion of errors in spatial orientation of the vehicle. The algorithm for computing the coordinates of the center in the TV coordinate system is based on image recognition theory. The solution of the problem is made difficult by the complex character of the figure and relief of the surface of Phobos, which required use of appropriate mathematical models for their description and rational choice of identifiable images for an analysis of the images and decision rules. Two classes of identifiable objects are examined: the linear contours of the figure of Phobos and very large craters on its surface; a half-tone image of the visible disk. The decision rules accordingly also differed: for objects of the first class this involved use of the least squares method; for those of the second class, use of an extremal algorithm based on a comparison of an image with its computed standard. The results of determination of navigational information images of Phobos obtained from the Fobos-2 probe in February-March 1989 are given. References: 2 Russian.

Docking of Spacecraft in Elliptical Orbit

927Q0056A Kiev PRIKLADNAYA MEKhanika
in Russian Vol 27 No 10, Oct 91 (manuscript received
1 Mar 90) pp 105-112

[Article by V. I. Popadinets, V. S. Burlaka, A. V. Ishchenko and I. G. Tsenkush, Cybernetics Institute, Ukrainian Academy of Sciences, Kiev; UDC 539.3]

[Abstract] The docking process considered is divided into two phases: 1) contact, securing of docking elements and reciprocal stabilization of vehicles; 2) subsequent drawing of the bodies together. The actual mechanism of this process is closely examined in the case of docking in an elliptical orbit and is illustrated in a quite simple mathematical model. Such a model is required for ensuring an on-line analysis and formulation of recommendations for extinguishing oscillations of the considered linkup of vehicles in the first phase of docking and control of motions of the vehicles in the second phase, taking into account that in each of the phases it is possible to use low-thrust jet engines of one or both vehicles in a manual control mode. The linkup of vehicles can be regarded as a discrete system whose motion is described by ordinary differential equations (the basic assumptions made in deriving these equations are stipulated). In constructing such a model particular attention is given to a schematic representation of coupling of the vehicles. Pertinent diagrams are presented, with detailed examination of the coordinate systems and the parameters characterizing position of the vehicles, with full derivation of the corresponding equations of motion. A more precise analysis of the docking process would require the use of a mathematical model with a large number of degrees of freedom, but this would considerably complicate the equations of motion, which is extremely undesirable in numerical research on the considered processes. Figures 2; references: 6 Russian.

'Luch' Satellite, 'Gonets' System to Provide Medical Data Links*927Q0047A Moscow IZVESTIYA in Russian 21 Dec 91
Union Edition p 9*

[Article by A. Blinov and B. Konovalov, IZVESTIYA special correspondents: "Space Bridge for Medicine"]

[Text] A space bridge has linked the workers of the Russian public health service and the Russian State Committee on Extraordinary Situations with participants in the Conference on Telemedicine held recently at the Armed Forces Medical Institute in Washington. Telemedicine is now becoming one of the new and vigorously developing branches at the contact between cosmonautics and the public health field. Its first test occurred after the tragic earthquake in Armenia when a space bridge was established between the United States and Armenia and consultations were provided for more than 200 victims.

The UN has declared this decade to be a period of bringing together of the efforts of the world community in order to alleviate the consequences of natural calamities. For the time being man is unable to control such catastrophes but is capable of alleviating the consequences of their fury. In the United States, USSR and some other countries "fast response" teams are now being organized for remedying the consequences of natural calamities. And for such events cosmonautics already is capable of providing the communication facilities so necessary under catastrophic conditions.

The telebridge between Moscow and Washington established during the time of the conference was at the same time a demonstration of a communication system via a Soviet satellite assigned the name "Luch." This satellite, constructed at the Krasnoyarsk Applied Mechanics Institute under the direction of Academician M. Reshetnev, intended for communication with cosmonauts working on the Mir orbital station and the Buran ships, now is serving purely terrestrial purposes. This also is a sort of conversion, due to which telebridges can be organized for different purposes.

Surface space stations at Shchelkovo near Moscow and in the American city Cleveland at the time of the telebridge were connected via the "Luch" satellite, which was in a geostationary orbit, and the television studio at Shabolovka and the conference hall in Washington were connected to them by ordinary and other satellite communication lines. And these can be any points in the USSR, United States or other countries. It is possible to organize reception points having small antennas with a diameter of about 2 meters in any terrain.

In opening the conference the co-chairmen of the working group, Professors A. Kiselev and G. Holloway,

as well as a NASA representative, Professor A. Nicogossian, emphasized that the use of telebridges at the time of catastrophes is only one of the possible uses. Cosmonautics will be helpful in organizing on-line communication among physicians for holding constant consultations, in assisting in the diagnosis of very difficult cases, in exchange of electronic data banks, in instruction of students and graduate students and in television conferences. The most remote regions of any countries of the world will be able to avail themselves of the services of the outstanding physicians of our planet due to space technology. It is only necessary to see to it that it will not be costly.

In this connection the "Gonets" system, developed by the Soviet Smolsat Association, which includes the Applied Mechanics Institute, the Scientific Production Association for Precise Instruments and Soyuzmedinform—our main telemedicine organization, is of particular interest. Under this project standard Soviet Tsiklon rockets will be used in putting 6 satellites at once into an orbit at a relatively low altitude—1500 kilometers.

A system of 36 satellites will make it possible to transmit and receive information with a lag not greater than 20 minutes. Surface facilities can be very simple: from small stationary and mobile points to portable and hand-held communication equipment of the type which the police carry. Already in 1992 tests of the "Gonets" satellites will begin and the system may begin to function permanently in 1993-1994.

As of today this is the cheapest and most advanced project for such a type of satellite systems. And although we frequently are inclined to condemn our cosmonautics, this is one of the few of our technologies which has received international recognition and which will be used by the entire world community.

Molniya-1 Communications Satellite Launched*LD0503100992 Moscow TASS International Service
in Russian 0945 GMT 5 Mar 92*

[Text] Moscow, 5 Mar (ITAR-TASS)—Another communication satellite, Molniya-1, was launched from the Plesetsk launching pad on Wednesday [4 March]. The satellite is to ensure the operation of a system of long-distance telephone and telegraph radio communication, as well as to transmit television programs to "Orbita" network points.

The "Molniya" rocket-carrier placed the satellite in a highly elliptical orbit with the following parameters:

apogee—38,998 km in the northern hemisphere;

perigee—629 km in southern hemisphere;

period of revolution—11 hours 42 minutes;

orbital inclination—62.9 degrees.

Ukrainian Goals in Establishing Independent Space Program Discussed

927Q0060A Moscow POISK in Russian No 49,
29 Nov-5 Dec 91 p 15

[Article by POISK correspondent Andrey Chirva under the rubric "Details for POISK" (Kiev): "Whose Apple Trees Are To Blossom on Mars?"—first paragraph is POISK introduction]

[Text] It has become known that the Ukraine is preparing its own space expedition. The national crew should set off on a mission next summer. It will work for the good of the sovereign Ukraine.

It is hard to say what the published report caused more of—applause or bewilderment. The space fireworks in an obvious political wrapper, some specialists believe, are merely millions of rubles, which have been launched to the stars. Especially as there are quite enough herocosmonauts, whom the Ukraine has given to the world.

The congress of the Federation of Cosmonautics of the Ukraine, which was held in Kiev, brought together not many participants, but more than serious things were discussed at it. For example, the fact that the development of space for many countries of the world—African countries included—is a very progressive and profitable matter. For example, Bulgaria is willing to give up everything if only to join the European Space Agency.

The nature of such an economic phenomenon is simple. To leave earth means to consider well with the mind, the engineering mind included. The latest technologies, which have been obtained by means of satellites and manned spacecraft, yield (at any rate, in highly developed states) revenues in the billions. And only a country that is indifferent to its future can refuse them.

If you judge from the former Union, earlier we did not grudge money for this so prestigious sector. Accordingly newer and newer scientific research institutes, design bureaus, and production associations appeared—some have not been declassified to this day. The Union is disintegrating, but will we really pull satellites apart as well?

But many satellites were also designed in the Ukraine. With good reason it is possible to call the Yuzhnoye Design Bureau, which is in Dnepropetrovsk, one of the active participants in the conquest of space. The general directors of the corresponding production associations, designers, and scientists, who were congress participants, were worried by the same thing: The space sector is in danger!

Inasmuch as the political compass for the present is more zealous than the economic compass, there is the threat that we will break aerospace science up into pieces. It is clear even to a child: What is divided is not whole. Here a question is posed: How is one to preserve this whole?

Probably by establishing state structures and cooperating. But will the Ukraine be able to become a space power? Are there enough forces for this?

"Last year the republic became a member of the UN Committee on the Peaceful Uses of Outer Space," Academician of the Academy of Sciences of the Ukraine Yaroslav Yatskiv relates. "An opportunity to tell about our successes has already presented itself. The world community received with interest, but also with a bit of bewilderment the report that the Ukraine in the development of space is not last. Of course, the industry of the republic, which works for the sector, and science were also an appendage of the complex that was directed from the center. And still we have an enormous intellectual and industrial potential. When they ask me as chairman of the Commission of the Academy of Sciences of the Ukraine for Space Research, what is there more of in our aspiration to become a space power—politics or economics, I reply: There is much of both.

"Let us turn to the advantages. The Ukraine is capable of developing spacecraft and the machinery for them, unique instruments. Scientists made what contribution they could to space materials science, biology, medicine, and the study of astronomical bodies. But the technologies of the remote sensing of earth are priority ones for the Ukraine and can already yield millions in foreign currency. At the same time the republic should not lock itself up, but should become as quickly as possible a participant in international space programs...."

Now in the republic mainly public organizations are occupied with space affairs. Some are proposing to pass the hat in order to finance the mission of the national crew. But you will hardly save the situation this way. And not without reason did specialists and scientists agree that it is necessary to establish the Ukrainian Space Agency—a governmental body that is supported by laws and finances. In this case such functions as the acquisition of its own scientific and technical potential in the development of space and the conclusion of agreements with states of the world community, first of all the former Union, could be assigned to it.

Both the Academy of Sciences and public organizations submitted such suggestions to the parliament and to the Cabinet of Ministers. There is the hope that the Supreme Soviet will find the time to discuss and legitimize the space initiatives and structures. But will the situation not develop according to the principle "sausage on the table is better than a satellite in the sky"?

"I think that the parliament, if it condescends to our problems, will give preference to sausage," Anatoliy Zavalishin, chairman of the Federation of Cosmonautics of the Ukraine, believes. "And still, I think, it is necessary to make the people's deputies change their mind. The development of space promises a large return. The 'incidental' benefits are billions and billions of rubles. It is possible to buy a very large amount of sausage with them. But the technologies remain unclaimed. And even

the obviously necessary achievements in the remote sensing of earth for the present are not finding extensive use...."

The reflections on how to guard the aerospace sector of the Ukraine against squandering, ill-considered privatization, and, thus, ruin are continuing....

Congress of Ukrainian Cosmonautics Federation

927Q0037A Kiev DEMOKRATYCHNA UKRAYINA
in Ukrainian 26 Nov 91 pp 1, 2

[Article by L. Dayen, Yu. Gagarin and S. Korolev Medal Bearer, under the rubric: "Market Without Retouching: "Hello, Space! I am Earth... Subjective Notes from the 3rd Congress of Ukrainian Cosmonautics Federation"]

[Text] In the memory of my generation the celestial epic in more than three decades has traversed the road from the highest triumph to complete disgrace.

In the beginning, space was surrounded with an heroic emotional aura. Then, as we once said, it put on a laborer's overalls. And lately it has become a target of deadly curses. In the consciousness of a significant section of impoverished society it has become kind of personification of a black hole into which all our people's billions have tumbled. One can understand the critical charge of people that are below the poverty level. Having been driven to despair by permanent shortages, empty shelves and exorbitant prices, they are looking for the cause for their impoverishment. And they have found the enemy in the person of ... Its Majesty Space.

Here and there one can hear: "Why go to space when there are so many unsolved problems here on Earth?"

Let us not be too critical of these voices. The cosmonautics of the former Soviet Union did sometimes give ground for dissatisfaction. The absence of a single concept of mastering space, high administrative and agency barriers, ostentation and window-dressing in organization of launches not to achieve a scientific effect but to get new Hero stars and decorations - all this has led to serious miscalculations - economic, political and moral.

But is it smart, is it business-like to throw away the baby with the bath water? Especially when the child - the missile and space technology - has long been standing firmly on both feet. Moreover, cosmonautics is the only field in which we have achieved the world-class level and which we can be proud of. And despite all omissions it still produces generous returns. Think of superlong-distance telephone communications and TV, prospecting for mineral resources, and navigation, ecology and weather forecasting. These are but several directions where the space field harvests multibillion results.

This is the socioeconomic background against which the Congress of the Cosmonautics Federation of the independent Ukraine has just taken place.

It is symbolic that it took place in the Kiev Planetarium Star Hall. Our land is famous for its stellar traditions. The greatness of Ukraine's deserving sons N. Kibalchich, Yu. Kondratyuk, S. Korolev and V. Glushko has not tarnished.

Over 1130 Baykonur veterans reside in the Republic. Many of them were the forum's delegates.

And the Congress' keynote speaker - Chairman of the Ukrainian Cosmonautics Federation retired Major General A. Zavalishin - is also a former Baykonurite, Deputy Commander of the Space Launching Complex. His speech, which was devoted to urgent problems of development of Ukrainian aerospace technology, attracted the delegates' attention by acuteness of his statement of burning questions, comprehensiveness and constructive approach.

"Ukraine", said Anatoliy Pavlovich, "has huge S&T and industrial potential in aerospace technology. We have performed serious space-related research. The launch rockets "Kosmos", "Tsiklon" and "Zenit", the space welding unit "Vulkan", the "Okean" spacecraft and system, and the world-renowned gigantic aircraft "Antey", "Ruslan" and "Mriya" were developed. Our aerospace industry has highly skilled personnel, scientific research institutes, design bureaus and leading enterprises and educational institutions. Being Ukraine's scientific, industrial and intellectual achievement, this industry makes it possible for our independent State to enter the world market with its product. It can become a source of stable currency income and a reliable guarantee of economic interstate relations...."

One can see that Space is working for Earth. Stars and daily bread are inseparable.

However, both the keynote speech and a number of deputies' speeches were fraught with alarm. Giving up further development of aviation and cosmonautics can lead to irreparable losses. They said that urgent actions are needed in order to preserve the industry. Otherwise - under the conditions of blind privatization - it is possible that the unique industrial facilities will be split into pieces and the scientific content will be reduced; instead, there will be higher labor content, the product will be "reinforced-concrete"-like, and technologies will fall behind. This would throw Ukraine several decades back.

"One cannot look at development of the aerospace industry from the standpoint of "this-minute" profit", said Deputy General Designer in Charge of Science for Design Bureau "Pivdenne", Yu. Smetanin. "But the industry's prospects are substantial. Currently, construction of a spaceport in Australia is being negotiated. We will sell rockets to Australia. For currency, of course. Brazil, South Korea, Taiwan and other countries that have reached high living standards call on us asking to create an aerospace industry there. So should we destroy and strangle ours, which has reached such great heights, only because we are poor?"

"If the space industry is stopped, it still would be possible to resume it several years later", noted Vice President of the Academy of Technological Sciences M. Pavlovskiy. "But decades would be needed to renew the personnel potential. Millions of unemployed and brain drain from the industry - this could be the result of the industry's decay".

"Ukraine is a space State. This is a fact!", stated Chairman of the Space Research Commission, Ukraine Academy of Sciences, Ya. Yatskiv. "It is Ukraine that was elected, on a competitive basis, out of six countries, such as Spain among others, to membership in the UN Commission on Peaceful Use of Space. I am convinced we need a national aerospace program. In the U.S. all space activities are coordinated by the Vice President. And what is the level of these activities here? It is necessary to create a Ukrainian Space Agency in order to coordinate the effort of all interested agencies, develop a unified concept of actions and financing of works in this field that are selected by competition".

Unfortunately, the underestimation of this industry was felt at the Congress too. I was shown a very long list of leaders of the Republic's Parliament and Government invited to the Congress. But none of them attended. And I am talking not only about leading persons in the Supreme Soviet and Council of Ministers, but also about Chairmen of Permanent Commissions and Ministers. Isn't this an eloquent fact?

But if the mountain will not come to Mohammed, then Mohammed must go to the mountain. The Congress has adopted an Appeal to the Ukrainian Parliament, future President and Government. Having related their plight and anxieties, the delegates are asking them to consider problems of the aerospace industry in the highest State organs, in order to give it a high priority as a promising direction for entering the world market. They think it is necessary to prepare and pass a Law on the Ukrainian Aerospace Industry and create within the Government a State Committee for the Aerospace Industry. Within the framework of conversion it is necessary to provide for changing the enterprises' profile to science-intensive production processes, in order to maximize utilization of their personnel and technical potential.

A timely idea. The thing is, one must weigh what is more profitable - force an aircraft manufacturer to make saucepans or sell an airliner abroad and buy one million saucepans, while preserving the high technological level?

One would like to believe that in the end those in the Parliament and Government of the sovereign State will heed the voices of the Congress' delegates - representatives of institutes, KBs [design bureaus] and factories that are at the forefront of the state-of-the-art S&T progress. More so as the delegates have urged all citizens to cast their votes on December 1 for a free and independent Ukraine. Chairman of country's Cosmonautics Federation, renowned cosmonaut M. Rukavishnikov demonstrated at the Congress great understanding of the

problems of our aerospace industry. He gave high marks to the level of this science and technology in Ukraine and said:

"And why not organize a tourist space business? Ticket price to an orbit for a Western businessman - \$10 million...."

But until the Government speaks up, it was decided to create a public Aerospace Committee under the Federation's auspices. A. Zavalishin was elected the Committee Chairman.

Not bad for a start.

We hope and believe that our stellar hour will come!

Collapse of Union Threatens Space Program

*LD2201061592 Moscow TASS in English
1121 GMT 21 Jan 92*

[By TASS observer Aleksandr Romanov]

[Text] Moscow January 21 TASS—Once powerful and grandiose Soviet space program may soon fall apart or simply be abolished as many deputies blame enormous expenditures for space research and military purposes for the current economic crisis in the country.

Many deputies believe "expenditures on space research and military expenditures are the cause of the current economic chaos," said academician Arkadiy Ursul, president of the Russian Space Academy, adding that annual budget expenditures on space research projects have never exceeded two per cent of the total.

"Nuclear power engineering has entered our life, and with it the problem of radioactive waste destroying the planet's ecology," Ursul said.

He said the academy is developing special containers for radioactive wastes and ways to transport them outside the solar system.

The academy's scientists are now developing projects to preserve the ozone layer, increase ecologically clean crops and use solar and space energy for the needs of the country's economy.

"Scientists believe technical means will eventually be able to neutralize such destructive atmospheric processes as earthquakes, floods, cyclones and typhoons," Ursul said.

Military Space Programs Must Adapt to New Conditions

*927Q0045A Moscow NEZAVISIMAYA GAZETA
in Russian 21 Nov 91 p 5*

[Article by Anatoliy Zak: "Drama of the Starry Host—the Space Subdivisions of the USSR Armed Forces are Facing the Most Difficult Problems in Their History"]

[Text] The reinforced concrete masses of these buildings rise high in many of our cities. Men in uniform stand guard in their severe doorways and the telephones inside are used only with tightly closed office doors. In these faceless buildings, in the language of the streets aptly nicknamed "mail boxes," the demonic armor of a world superpower has been hammered out for many years. Here the best minds of the country day and night fashioned the starry history of our civilization. But today the nameless heroes of the rocket-space era are at the crossroads, their work was thankless and the future is uncertain.

The military space departments have attempted to adapt to the new times: conversion programs have been developed everywhere, attempts have been undertaken to become self-supporting, in the space units of the Ministry of Defense even a press service has made its appearance, a fact in itself causing surprise among both the generals and among the journalists. However, things are going increasingly badly: the conversion is usually transformed into actions which make little sense: as a result bicycles, artificial limbs and mixers, produced in small lots in space facilities, cost space money. Without question the country has been choked with guns instead of butter, but the vulgar understanding of conversion is only leading us away from the desired prosperity. The Yuzhnoye Design Bureau at Dnepropetrovsk, the key enterprise for production of the Zenit booster rocket, became a victim of such a policy. The Zenit is the latest two-stage rocket system, capable of putting a payload up to 14 tons into orbit, a system which Western specialists call the carrier of the 21st century. It was the principal candidate for use as a means for the launching of satellites from an international commercial cosmodrome on Cape York in Australia and potentially could have brought the country an enormous profit in hard currency. Two amplified variants of the booster were developed. Now, however, the existence of the Zenit has been left hanging. The cataclysms of recent years have thoroughly disrupted the beautifully organized production mechanism, discipline has weakened and many experienced specialists have been laid off. The results were deplorable: after twelve successful launchings from the beginning of use of the Zenit in 1988 there were two accidents in a row, the destruction of the launch pad.

Nevertheless, the overwhelming number of specialists speak out in protection of the Zenit system, at the same time that their attitude toward the famed Buran is cooler.

In the press service of the space units of the Ministry of Defense I for the first time I heard official confirmation of a long-evident fact: the functions of the booster rocket (the expendable Energiya) and the orbital stage (Buran shuttle) have been separated because at the pertinent time there were no possibilities for developing the main shuttle engines. Accordingly, they were placed on a stage which perishes in the atmosphere, although they are the most costly part of the system and are the most worthy for repeated use, as occurs, for example, with the Space

Shuttle. All this means that the Energiya-Buran system from the economic point of view is disadvantageous in comparison with "classical" one-time carriers, so that now, under conditions of limited resources, the flagship of Soviet cosmonautics is carrying nothing into space. However, the opponents of space shuttles frequently forget that the most promising tasks in space, like the assembly of objects there or their removal from orbit, are not within the capabilities of the most modern single-use rockets. However, the design of the Energiya is such that it makes it possible to incorporate the qualities of a shuttle without difficulty. In their time American designers developed a system for the return of a still more bulky rocket, the Saturn 5. And although such plans were never realized, they merit the most serious attention now. Assuming that the initial appropriations are adequate, necessary modifications can be made to the Energiya, and as a result we would obtain a superpowerful and economical vehicle whose importance for our future is difficult to overestimate. Fortunately, for the Buran not all is yet lost. For the first time, after many months, from the mouth of the chief designer of the Molniya MPO (developing the Buran glider), Gennadiy Dementyev, I heard optimistic news: the launching of a Soviet cosmoplane will take place late in 1992, the flight program will not be changed: an unmanned launching and docking with the manned Mir system.

Purely military flights probably are a still more contradictory element in Soviet cosmonautics. The remaining secrecy barriers, extending far beyond the framework of reasonable national security considerations, still do not make it possible to form any precise idea concerning this matter. The representatives of the space units of the Ministry of Defense agree that it is absurd to launch "anonymous" satellites having only sequence numbers, especially taking into account that these space "phantoms" are identified in the West several hours after they are put into orbit and anyone so wishing can learn their true purpose, even in the journal *Spaceflight*. However, changing this outdated information policy is rather complex because even within the Ministry of Defense space is divided among such subdivisions as the Main Surveillance Administration of the General Staff, owning surveillance satellites, and the antiaircraft defense forces, using satellites for early warning of launchings of hostile ballistic missiles. In these formidable departments, as before, it is assumed that the public has no interest in space activity and today's press is striving only to worm out state secrets. But a prosaic reality is perceptible behind these secrets. The representatives of the space units have asserted that our armed forces have never given due attention to military satellite systems. Now, however, launchings for such purposes are becoming increasingly fewer. This is not so good as it may seem because American experience demonstrates very clearly that military satellites make possible a sharp increase in efficiency and a sharp reduction in the number of communication, guidance, meteorological support and surveillance subdivisions. At the same time in the armament of our army up to the present time there formally

remains an antiquated system for damaging hostile satellites, losing any military or political sense.

...Today there is still a chance to bring our priceless space program back from its deadly spin, but tomorrow may be too late. As stated by Aleksandr Radionov, director of the press service for the space units of the Ministry of Defense, "when over enormous expanses of our country the television sets go blank there will be no need to explain to the people the merits of communication satellites, but years may pass before it would be possible to deploy new space systems."

Military, Civilian Interests Competing Over Baykonur Cosmodrome

927Q0049A Moscow KOMSOMOLSKAYA PRAVDA
in Russian 28 Dec 91 pp 2

[Article by S. Brilev, KOMSOMOLSKAYA PRAVDA special correspondent, Leninsk: "Baykonur Removes Its Shoulder Straps"]

[Text] "Well, you're going to take a look at that which we no longer own," they said to me before my takeoff to Baykonur at the press center of space units of the Union Ministry of Defense....

It was impossible to say where my flight was to. And not due to considerations of keeping a state secret. Situated on the banks of the parched Syrdarya, the city of "earthnauts" still does not have an established name. Judging from the map, the city does not exist at all. On the airline ticket for special flight No 565, which can be purchased only by special permission only and only in a special ticket line, the point of destination is designated as "Terminal." That's also the way the stewardesses announce it. On my assignment identity card in the columns for "profit" and "loss" they put down N/A. Finally, the inhabitants feel that they live in "No 10," as the rocket personnel are accustomed to call their residential zone. And all this is Leninsk, Kzyl-Orda Oblast, which by general conviction soon, in the spirit of the times, will change its name to Baykonur or some other name without ideological content.

In addition to all else, the inhabitants of this, one of the youngest cities in the world, wage endless arguments about the date of its founding. The people in uniform are sure that the year 1955, when the first military engineers arrived here, must be considered such. Vladimir Savchenko, chairman of the city soviet and executive committee (and, incidentally, also a lieutenant colonel in the reserves), is absolutely sure that "Terminal" - "No 10" - Leninsk became a city in 1961, at the time when Soviet authority appeared here. Thus, is the garrison situated in the territory of a military settlement or a city?

The city has its legends. Some time ago Nursultan Nazarbayev visited Baykonur again. And driving through the city in a car, accompanied by General Kryzhko, head of the cosmodrome, and chairman Savchenko, he saw an old Kazakh along the road. The

president ordered the motorcade to stop and got out to chat with the old man. The latter asked him for one thing: to supply him a refrigerator.

"And did you go to the authorities? Who of my companions do you know?" asked the president.

"That is General Kryzhko, head of the cosmodrome. But the other I see for the first time," responded the old Kazakh, who eventually received the refrigerator through the army exchange.

In actuality, virtually everything which Leninsk now has, was from the beginning constructed by the military. For example, all the residences, hospitals, stores, heat and power transmission lines. Even the footbridges and green plantings are under the oversight of the Ministry of Defense. The only thermal electric power plant in the armed forces, at whose control panel sit officers and soldiers with the blue shoulder straps of the Air Force, operates in the city. The entrance into the bakery also more resembles and actually is a military check point.

The officers with whom I met call the civil authorities dummies or comic figures and I heard only one thing from them: the city must, as before, remain under the control of the military.

"Visualize that civilians appeared in this same bakery in place of soldiers. It would be necessary to raise the wages at once," assured me Lt. Col. Yaroslav Nechesa from the cosmodrome press group.

"The garrison is quartered in that place where it should be according to the laws of the state," insists Savchenko, in turn. "To be sure, if someone builds something on the ground, then that's his property. But then let him at least pay taxes. And indeed, today, the military are not free of these taxes."

Savchenko also speaks of a change in responsibility for this same thermal electric power plant and the bakery. The arguments are quite logical: why should these be the concern of men with shoulder straps?

However, not everything boils down to financial-economic counterpropaganda. There are certain relationships between the Soviet and military authorities in the garrison-city and that which is usually called high policy. Sixty-five of the hundred deputies in the city soviet are officers of the garrison and Savchenko is sure that the commanders have intentionally sent them on special assignments for a half-year in order to detach them from exercise of their duties as deputies. Also at the cosmodrome headquarters they have service duties in mind. Thus, for example, some officer-deputies were actually sent out into the steppe for several months in command of subunits for the collection and use of ecologically dangerous fragments of rockets which had not completely burned up in the atmosphere.

So that in the city of "earthnauts" it was in no way possible to get a clear answer as to who owns the city of Leninsk. One thing became evident: the military and

civilians in Leninsk, when speaking about one another, pull no punches. But they are just learning to talk directly to one another.

According to the stories of the "earthnauts," prior to the onset of the 1980's there was only one Kazakh in the city, who worked as a yardkeeper. But later, after a flare-up of cholera in the adjacent Kazakh Boldinovka, the settlement itself was eliminated and the inhabitants resettled in one of the houses in Leninsk. Today no one is surprised when a salesperson in a store speaks to some customers in Russian and to others in Kazakh.

On the morning of 8 December a slight panic prevailed in Leninsk; "They have abandoned us... Where is Nazarbayev, does he know what happened at the conference in Belovezhskaya Pushcha?"

At the center do they remember Baykonur? The former just all-powerful General Secretary Gorbachev arrived at the cosmodrome the last time in May of 1987. His then-time phrase that "the cosmodrome was constructed for a long time, forever" to this day adorns without exception virtually all the "political fences," as the numerous propaganda stands in Leninsk are so pathetically called. The city was always dependent on the center. But four and a half years have passed and a period has arrived of endless declarations concerning sovereignty of this and independence of that, weekly decisions to establish one union or another....

One of the first bold initiatives with respect to sovereign control over "Star City" belongs to Russia, although President Yeltsin has repeatedly criticized what he regards as an overambitious space program. Nevertheless, by a decree issued by the RSFSR Council of Ministers on 5 November 1991, for example, the Mir station, flying in space, was handed over to the Energiya NPO (Scientific Production Association). And on 15 November the main resources of this scientific production association, including those situated at the Baykonur cosmodrome, were handed over to management of the RSFSR Ministry of Industry.

And at this time complete uncertainty prevails in the test units operating under the "Energiya" program. In the words of the commander of one of such units, Lt. Col. Glukhovchenko, a shortage of officer personnel is being felt acutely in the subdivision: some have left due to reduction in staff, others have departed by themselves. The unique airfield (runway of the best kinds of concrete with a length 4.5 km and a width 86 m), on which the Buran sits, looks sad indeed. According to the rules, it must be constantly kept in a dry state. But for this there are insufficient personnel... and inadequate fuel for the machines to maintain what is, I repeat, a unique object. And construction of the right launch pad for the Energiya has virtually come to a standstill.

Nazarbayev is pursuing a wait and see policy. In principle for the residents of Leninsk he is the most well-liked politician: he spoke out for preservation of the

Union and what is all-important for most of the inhabitants of the city, for unified armed forces. It is indicative that the people of Baykonur, so it seemed to me, having a more than skeptical attitude toward Gorbachev and Yeltsin, in the recent elections for President of Kazakhstan very amicably voted for Nazarbayev, who, incidentally, during the last year visited the cosmodrome three times.

Nazarbayev is behaving very cautiously with respect to the cosmodrome and does not make sharp declarations on the subject. And at the same time people associated with the republic government have already developed vigorous activity at the cosmodrome. For the time it causes ironic smiles among the military. But, as it was found, it is entirely possible that in the near future precisely these former officers of the cosmodrome, who have gone into the reserve, will take authority over Baykonur into their hands.

In September a decree was issued on the formation of a Kazakh space agency.

"Why has all this suddenly become Kazakh? But, indeed, today no one is making claims to Novotallinsk port," said Sergey Nechayev, one of the enthusiasts for establishing the agency, trying to convince me. "The principal problem, naturally, is ownership. On 31 August Nazarbayev signed a decree on transfer of objects under union jurisdiction to the jurisdiction of Kazakhstan. And the sole question on which the State Property Commission of the Kazakh SSR for the time being has made no decision is the objects under the Ministry of Defense of the Union. The cosmodrome should operate on the basis of a healthy commercial interaction among rocket launchers, those ordering the flights, producers of carriers and space vehicles. Where is it written that this should be the concern of the military? If the cosmodrome continues to operate on the basis of budget financing, under present-day conditions this will inevitably lead to collapse of the entire system.

Incidentally, among the possible candidates for the post of president of the agency is Gubanov, the general designer of the Energiya NPO. In the event of his arrival at leadership of the agency the chances of Kazakhstan becoming coordinator of the former Soviet space program will increase. As the reader can already see, the supporters of organization of a Kazakh agency understand that the republic alone cannot support the cosmodrome. Precisely for this reason they propose the establishment of a "spaceport," on the principles of a joint stock company bringing together similar agencies in the former Union republics, producers and operators of space equipment, for attracting capital from private banks, something similar to the European Space Agency. Such an association should naturally pay taxes to Kazakhstan.

A very enticing idea, but one giving rise to numerous questions. For example, in such a case what would be the

fate of the military, constituting the backbone and absolute majority of cosmodrome personnel? Nechayev is sure that in the event that a "spaceport" is established the present-day officers will have to take off their shoulder straps, becoming highly paid civilians. But despite all the advantages many of the military are purely psychologically unprepared to leave the army.

But for the time being Baykonur is still in operation. It is difficult to figure out what will be the result of the numerous disputes in Moscow and Alma-Ata, at the cosmodrome headquarters and in the kitchens of Leninsk. Each month the question arises as to where to get the money at least to pay the cosmodrome employees their wages. And in the stores of "No 10" lines have appeared for bread and for the cigarettes on sale, only the American "Atlantis" cigarettes with an image of the space shuttle on the package. "Terminal" is far away. God forbid that it become the backyard of a once great country.

Commentary on U.S. Radar Imagery Satellites

927Q0044A Moscow KRASNAYA ZVEZDA in Russian
18 Dec 91 pp 5

[Article by Yu. Makarov, colonel: "Space Radars in the Surveillance Service"]

[Text] For a long time it remained a difficult problem for surveillance purposes to obtain highly detailed imagery from space of land and sea areas, as well as specially camouflaged objects, when meteorological conditions were poor or when there were low illumination levels. It was known theoretically that this problem could be solved by applying the radar principle. However, there were great difficulties on the path of practical realization of this idea. Lacking were a technology for developing high-speed on-board computers, corresponding antenna systems, economical power sources for on-board radar transmitters, high-speed reliable relay channels for transmitting great volumes of data to surface processing points and efficient outfits for digital methods for forming and interpreting radar imagery.

All this entered into contradiction with the striving of surveillance personnel "to see all and hear all" and restrained a broadening of its capabilities.

Beginning in the late 1970's the United States undertook a systematic "storming" of technological barriers for the purpose of establishing a space system for conducting around-the-clock and all-weather surveillance of strategically important regions, in particular, in the territory of our country.

It was the intention of the placers of the orders that satellites with radar sensors aboard should reinforce the capabilities of the already existing space system for surveillance imagery on the basis of artificial earth satellites with optoelectronic equipment. And also to "open its eyes" for observing objects under conditions of

considerable cloud cover, with low levels of solar illumination and at nighttime, as well as in other situations when the optical system becomes of no assistance.

Already the first full-scale experiments using radar systems for scanning the Earth's surface, carried on the Space Shuttles in 1978-1984, yielded encouraging results. Large-size objects with linear dimensions exceeding 25-30 m were easily detected and identified. Imagery of objects was formed at ground centers several minutes after their irradiation from a spaceship. However, the principal objective of the program, reliable detection and identification of small objects, was still a matter of the future.

This goal was attained only in 1988, ten years after the onset of intensive work in this field. In December the Atlantis shuttle put into orbit a 14-ton radar imagery surveillance artificial earth satellite which was assigned the code name Lacrosse. Its development and construction cost more than 1 billion dollars.

According to an evaluation by American specialists, this artificial earth satellite constituted a representative of a new generation of spy satellites. From an altitude of 600 km it was capable of "seeing" beneath a dense cloud cover and during the dark time of day objects with linear dimensions up to 3 m. Through the communication channel of a system of relay satellites the Lacrosse artificial earth satellite can transmit its information to ground centers on a virtually on-line basis.

Several Lacrosse artificial earth satellites have now already been launched into the black expanses of space. They direct invisible rays to objects of interest to them. Then the reflected signals, processed in an on-board high-capacity computer system, are transformed into fluxes of electronic information which through space communication channels are forwarded to ground computer centers for final processing.

At the centers the information is processed, analyzed, compared and transformed into the final surveillance product—imagery of a missile position, launch site, aircraft, ship, railroad center, naval base, etc.

Radar imagery surveillance from space has already long been given great importance in foreign publications. Its future possibilities make it possible to conclude that it will be capable of detecting objects not only under a dense cloud cover, but also to "glance" beneath the leafy crowns of a dense forest, beneath the soil, and to "catch sight" of a flying aircraft or missile.

Space radars are opening a new page in technical surveillance. And under conditions when on instructions from the administration in Washington American surveillance agencies have initiated intensified monitoring of the events transpiring in our country all this is acquiring special importance.

Projects Planned for 1992 International Space Year

927Q0046A Moscow KRASNAYA ZVEZDA in Russian
24 Dec 91 p 3

[Article by M. Rebrov, KRASNAYA ZVEZDA scientific reviewer: "1992—A Space Year"]

[Text] The year 1991, the Year of the Sheep, is ending....

It is possible to review all the space events of the outgoing year and sum up the results. However, while casting an untroubled glance at what has passed, it is impossible not to take a look into the future. What stages will the mastery of space pass through during the next 10 or 20 years? And here, however strange it may seem, within the boundaries of any one country, even a very powerful one, it is extremely difficult to answer this question.

If the people of different countries in actuality want to cooperate in the space field, a real possibility will appear for organizing in orbit a massive and multipurpose international scientific research and experimental industrial center for making use of the possibilities afforded by a vacuum, radiation and weightlessness for scientific and technological purposes. During this same period it will be possible to establish bases for the accumulation of solar energy in space which will transmit it to the Earth in the form of directed beams. There are realistic possibilities for establishing manned laboratories on the moon which would make it possible to be concerned not only with scientific problems related to study of the origin of our solar system, but also to use them for obtaining very important types of mineral raw materials from the lunar subsurface.

In short, all projects, even what may at first glance seem to be the most fantastic, can be carried out, provided that earthlings undertake them together. A good chance for such a unification of forces and resources will be provided by the year 1992, declared by the United Nations as the International Space Year.

Such a global event is being observed for the first time and is tied in with two memorable dates: the 35th anniversary of the space era and the 500th anniversary of the discovery of America by Christopher Columbus. These events form part of the same series because both favored the vigorous progress of terrestrial civilization and a growth in its powers and capabilities.

The Soviet Union became one of the initiators in proclaiming the International Space Year. A program of the measures to be carried out in 1992 was announced on 19 March 1991. These will include specific launchings of space vehicles for different purposes: the "Koronas" astrophysical observatory for multisided solar research, the "Bion-10" biological satellite, the "Meteor" meteorological complex and the modernized environmental

satellite "Resurs-01." Work will continue in the international expeditions on the "Mir" orbital scientific complex and the joint investigations of the Earth using instrumentation developed by scientists of different countries will continue....

On 22 April plans call for observing the large-scale event "Day of Mission to Planet Earth." It will include ten projects related to study of the greenhouse effect, ozone layer, melting of polar ice, state of forested expanses and water basins, evaluation of natural resources, environmental pollution, etc.

Conferences, seminars and symposia will be held during the International Space Year on such subjects as research on the Earth from space, investigations of the world ocean, use of space vehicles for monitoring adherence to international disarmament agreements, for navigation and communication, search for planes and ships which have experienced misfortune along air and sea routes, education, public health, commerce, etc.

Competitions for better technical projects, for scientific and technological experiments which may be organized in space, races of "space sailboats" on Earth-Moon and Earth-Mars trajectories and large-scale programs for the search for extraterrestrial civilizations—these are only a few of the measures with which 1992 will be packed.

The International Space Year will be a year for everyone. Postal miniatures, covers with special cancellations, commemorative coins and pins, books and albums, video films, cassettes with "space" recordings. It is planned that all of these things will be issued and released by national space agencies of the world.

Yuriy Gagarin, flying around the Earth for only one and a half hours, stated that our Blue Planet is very small and very beautiful and it must be cared for. Today we are becoming increasingly conscious of this surprisingly simple truth.

We are all people. We are all pilots of the gigantic spaceship of hope, whose name is Earth. But the term "gigantic" is extremely conditional. Tragedies in a single, be it even a very small region, very quickly are echoed in the pain of people on the entire planet. And I want to believe that reason, nobility and good feelings will not overcome man only on days of calamities. But always!

Our planet is beginning its next revolution around the sun. The new year is arriving. According to the oriental calendar it will be the Year of the Monkey, according to our global calendar it will be the Space Year.

May this space year be a happy year for all earthlings!

'Crisis' of Cosmonautics at Start of International Space Year

927Q0058 Moscow IZVESTIYA in Russian 14 Jan 92
Morning Edition p 2

[Article by S. Leskov: "The Space Year: Our Space Program in Is Crisis"; first paragraph is source introduction]

[Text] The UN has decreed 1992 the International Space Year. As a result of that, many countries have planned broad-ranging deeds. But will the former USSR, the former world leader in cosmonautics, find it possible to include itself in those plans?

I am absolutely certain that 999 out of 1,000 people today couldn't name the cosmonauts who have been working aboard the Mir station for several months already now. And that indifference is an infallible indicator of the profound, progressing crisis in the once flourishing sector. In terms of all the misfortunes, that crisis has reached its most unfortunate period at a time when space programs throughout the world are not only witnessing acceleration—they are also undergoing a fundamental reorientation.

May I venture a prediction for the space year in the former USSR, which once held the lead in cosmonautics, but today is slipping increasingly rapidly into crisis? Attempts will be made to raise the abolished Ministry of General Machine Building back up under a new sign after imparting to it the same dictatorial powers. Meanwhile, in the opinion of such authoritative specialists as academicians Yu. Ryzhkov, V. Avduyevskiy, and V. Mishin, we must create without delay a Russian Space Agency, a counterpart to NASA, in place of the abolished ministerial structures, and for controlling the sector at the interrepublic level, we need to use the experience garnered by the ESA. That advice seems to have been heard: at a meeting held in Minsk just before the New Year, a decision was made to create an Interstate Council for Space. Moreover, life is pushing the space program toward commercialization, while our share of the space markets, despite all the strivings of Glavkosmos, is laughable at 0.1 percent.

As for that part of the space "iceberg" that is visible to everyone, the orbital complex Mir, even such patriots of the sector like B. Olesyuk, the most senior staff member at the Flight Control Center, have their doubts today about whether it's worth it to keep a crew aloft just to maintain the efficiency of a station where practically no research is being done. The weeklong visits of foreigners to Mir remain a reality these days. We expect two visitors during the Space Year—a German and a Frenchman. The prospect of hard currency, of course, takes our breath away. But might it not be a good idea to think about how much money it will cost us to be keep hosts in space all the year round?

Moreover, it would be a grave error to assume that in the Space Year, the burdens affect everyone who is associated with space program. As we know, it is in this very period of general collapse that great fortunes are being born. Some time ago, in the fashionable building of the new Flight Control Center that was meant for controlling the yet-to-take-off Buran spaceplane, a military-industrial exchange was opened. An unheard-of thing in the "defense sector," which is natively ill-adapted for market relations! The exchange hasn't resulted in any revival of the sector, but the conversations about the exchange are legion. Or to be more precise, they're not about the exchange itself, but about the annual six-figure incomes that are had by the leaders of the Central Scientific Research Institute of Machine Building, which is the head institute of the sector where the exchange is quartered. Against the backdrop of the decline of the space program and the half-beggarly existence of most of its specialists, this is truly a curious topic for conversation. Judging from the fact that refutations of a number of articles have not ensued, and the newspaper clippings themselves are hanging all over the enterprise, the super-incomes of the leaders of a sector that already has one foot in the grave are no figment of the imagination. In human terms, this much is clear: this could be our last chance. It only hurts the space program....

Western managers suggest first of all increasing the appropriations to fields that have declined, but hold incontrovertible promise. The prescription, as it were, is written for today's space program. But here's an example from real life. Near Moscow, in Kaliningrad, which contains a cluster of design bureaus and institutes that is the largest not only in the country, but apparently in the world, a group of enthusiasts set up an aerospace school. Admission to the school begins at the age of five, and the program there is surprisingly packed and varied. The aim is to train specialists of a new level that would not only involve mastery of narrow technical skills, but would also produce a well-round personality. We could talk long about the school—that's another topic all by itself. But an indication of its level is the fact that the kids this year were invited to America, where, by the way, there are many such institutions.

But back at home, the school is on the brink of closing every year, because of the orphan-like financing. It has to beg for every kopeck, as if for alms, from the surrounding "space" enterprises, for whose future the school was created. The problem supposedly involves determining under which item to enter the expenditures. But that, it would seem, is merely a sly excuse. The deputy director of that same Central Scientific Research Institute of Machine Building explained the strategy to me a year ago: the sector does not envision any need for personnel in the near future, so the school is of secondary importance. I don't even want to comment on a position permeated with the psychology of the short term. By the way, the money needed to run the aerospace school for an entire school year is a third of what some of the so very zealous leaders take annually from their amazing exchange.

The Space Year will fly by quickly. It's not likely to bring much joy to our space program. It probably won't bring any real deluge as the result of the activity of certain leaders. Nevertheless, we must, in this period that tests us so severely, have the wisdom to maintain the potential of a most important scientific and economic area. Then the celebration will again return to our streets.

Responses to Missile Launch from Baykonur

Kazakhstan Not Informed

*LD2301210792 Moscow Radio Rossii Network
in Russian 1100 GMT 22 Jan 92*

[Commentary by Igor Ambrosev]

[Text] [Announcer] The problems of the Army, of the officers, of the strategic forces, of nuclear weapons, and so forth seem to be becoming one of the constant subjects of discussion in the CIS [Commonwealth of Independent States]. But for the moment the politicians are hardly able to come to an agreement about the most fundamental issues, and life is throwing up ever new problems.

The newspaper IZVESTIYA reported on one of them in the Moscow evening issue for 20 January. It was unexpectedly discovered that exactly a month ago space units of the Armed Forces conducted an experimental launching of a missile from the territory of sovereign Kazakhstan. And precisely the launch vehicle was remodelled from an SS-19 intercontinental ballistic missile. The State Defense Committee of the Republic of Kazakhstan was not informed of the planned launch. Here is a commentary from Igor Ambrosev:

[Ambrosev] First of all I would like to warn against interpreting this event as, let's say, a reason for exacerbation in Russian-Kazakhstan relations. Unfortunately, the headline in IZVESTIYA directly prompts one to such an interpretation. The headline states: Moscow launches a missile from Kazakhstan, but informs Washington of this and not Alma-Ata. However, the situation is not as simple as that. One should not search for the roots of what happened in Moscow, but most likely in the Belovezhskaya Pushcha. Yes, yes, precisely there, and precisely at the time when the start of the process of reorganizing our statehood began, a process which turned out to be extremely complicated.

The unexpected things on our new path are occurring in clusters. And the launching of the missile clearly reflects the entire complexity of the situation.

Let's go back a month to the middle of December. What happened then? There was joy at the abolition of the center of the empire. The groundwork was being prepared for the meeting on 21 December in Alma-Ata. But not only that: The process was unfolding of—I apologize for the pun—folding up the activity of the Union structure. Well, except for the Armed Forces. This is how the formulas in the Belovezhskoye agreement read on the

united command of common military and strategic space. And in these circumstances the launching of the missile on 20 December, on the eve of the meeting in Alma-Ata, could in no way be considered extraordinary.

However, on 20 January, after Evans and Novak of THE WASHINGTON POST, who have been known since the times of the cold war, assessed the launch as a blatant violation of the treaty on reducing strategic offensive missiles, the problem started to appear somewhat different. At the Defense Committee of the Republic of Kazakhstan the report by the U.S. side that a missile had been launched was at first denied. In actual fact, since Alma-Ata had not been informed of the launch, this means that the launch did not take place. This is from the point of view of logic and of the declaration of sovereignty and the republics' respect for each other's rights. But one has to amend one's position according to circumstances which can be disrupted by logic [as heard].

The circumstances are as follows: The plan for the experimental launch of space objects for 1991 was ratified by the Military Industrial Commission of the USSR in February 1991 and confirmed in July that year. And even if the commission was abolished, no one contemplated abolishing its plans. The issue of notification of any kind of military activity is not regulated by any interrepublican or interstate treaty. This is precisely the reason why Washington, which is linked with Moscow by means of the treaty, was informed of the launch and Alma-Ata was not.

And what is most dreadful is that these absurdities will continue in the future, too, until such time as a reinforcement of relations among the sovereign republics with strictly binding treaties is started. Serious, detailed, multilateral treaties are needed, at least with regard to issues relating to the strategic forces. But a treaty is needed reinforcing bilateral relations on all the issues that are important to one pair of sovereign states or another. At least what has already been established in Minsk, Alma-Ata, and in Minsk again cannot be effective. And as far as Evans and Novak from the WASHINGTON POST are concerned, they have simply not restructured themselves yet, and their attempt to present the affair as if the missile was launched by the new, independent Republic of Kazakhstan is in their old spirit. THE WASHINGTON POST needs to have its attention drawn to the behavior of its observers. It is time to reject the stereotypes of the cold war, as Vadim Bakatin and Andrey Kozyrev are teaching us.

Official Interviewed

*LD2301212392 Moscow Teleradiokompaniya
Ostankino Television First Program Network
in Russian 1500 GMT 22 Jan 92*

[From the "Novosti" newscast]

[Text] In the last two days there has been a lot of talk about a ballistic missile launch from the territory of Kazakhstan. U.S. officials began to wonder who made this decision and whether the Kazakhstan authorities knew about this. But the rumors about the launch of a military missile were highly exaggerated. [A page from IZVESTIYA is shown with headline: Moscow launches a missile from Kazakhstan, but informs Washington of this and not Alma-Ata]

[Begin recording] [Unidentified reporter] The article constantly mentions that the launch was carried out on the decision of the Soviet Military Industrial Commission. Now there is no such commission, but the launch was carried out. Why is there a connection?

[Y.G.Gusev, deputy commander of space units in the Defense Ministry] In February 1991 the plan for the experimental launches, the launches for the needs of the national economy and space research, was approved by this commission. The same commission confirmed the plan for the second half of that year. Until the new structures are created the old plans are in force. It was said and explained repeatedly in the decrees and decisions of the Russian Government that during the transitional period it would be guided by the legislation of the former Soviet Union. Therefore, at the moment of its implementation, the launch was carried out in strict accordance with the directives which had been drawn up.

[Reporter] If we are to reject the Military Industrial Commission decisions now, then all the civilian launches should be cancelled too?

[Gusev] Of course, since no other document exists which establishes a plan for the launches for the purposes of the national economy. [end recording]

Further on Launch

LD2301215692 Moscow Teleradiokompaniya
Ostankino Television First Program Network
in Russian 1800 GMT 22 Jan 92

[From the "Novosti" newscast]

[Text] Reports in a number of newspapers about the supposed malfunctioning launch of a SS-19 missile from Baykonur has aroused a number of misinterpretations not only here but abroad as well. General Gusev, deputy head of space resources, has agreed to explain the situation for our program.

[Begin recording] [Slichenko] This rocket is called Zenith. There have been 15 launches, two of which had accidents. Only 40 minutes elapse from the time of reaching the pad until the launch. Zenith was to replace the famous Semerka which took people into space. Americans who watched the launch and examined the technical characteristics said: This is impossible—to

create such motors we need 10 billion and 10 years. The launcher was developed and tested at the Baykonur cosmodrome.

The most important thing in this [IZVESTIYA] article is the headline: Moscow launches a missile from Kazakhstan, but informs Washington of this and not Alma-Ata. The missile was launched from Kazakhstan, the Baykonur cosmodrome, is there any difference here?

[Gusev] Undoubtedly there is a difference. The missile was launched from Baykonur cosmodrome. If you follow the logic of the article's authors then the missile was launched from Kazakhstan, it was launched using its resources and the appropriate button, and if this is a military missile, then Kazakhstan has the right to launch such military missiles. Today, as we know from the results of the Alma-Ata and Minsk meetings, there is a single nuclear button and, therefore, the information in this article does not correspond to reality. The launch took place in Kazakhstan, but on Baykonur cosmodrome territory.

[Slichenko] So it turns out that it is practically impossible to stop scientific research work on missiles now in order to create new missiles, not military, but civilian ones.

[Gusev] Of course, in order to turn a military missile into a civilian one it is necessary to introduce the necessary construction and technical changes, and of course when creating any new space carrier a program of flight tests is created during which flight launches take place.

[Slichenko] Is it possible to say that military launch tubes, launch tubes which contain military missiles, will in future launch purely civilian loads?

[Gusev] Yes, you can put it like that. The treaty on cutting strategic offensive weapons envisages that every country has up to 20 launch pads, including vertical launch tubes, with minimal alterations of the appropriate equipment, which will make possible launching useful loads into space.

[Slichenko] The launch is managed from Moscow. To what degree does Kazakhstan or Alma-Ata have any influence on this work?

[Gusev] Kazakhstan is only notified about the launches—the flight path, the area where the first stage falls—so that the local authorities can ensure safety for the launch. Kazakhstan is notified about every launch in this manner. It is beyond the scope of any republic, in my view, to implement any space program in our conditions. This is connected to the infrastructure of the whole missile-space industry and also to the infrastructure of space involved bases situated throughout the whole territory—specifically in five republics—of the former Soviet Union. Therefore, to say that one of the republics—apart from Russia—can work independently on space would probably be inaccurate today. [end recording]

Views of Space Veteran N. Ye. Dmitriyev on Importance of Space Program

927Q0059 Moscow VOZDUSHNYY TRANSPORT
in Russian No 1, Jan 92 pp 8-9

[Article by V. Petrova, correspondent for VOZDUSHNYY TRANSPORT, includes paraphrase of comments by Nikolay Yegorovich Dmitriyev, general in the reserves: "Such Moments Make Life Worth Living: One Man's Biography"]

[Excerpt] [Passage omitted] Why would a poor country spend such gigantic amounts on that outer space? Such a point of view—which just yesterday would have been impossible, absurd, and seditious—is enunciated today not only by intrepid dilettantes who boldly tackle any topic that comes up, but also by politicians, state figures, economists, and scientists. The calls to cut back space investments are ringing out ever more steadily and ever louder. And more and more people who, until recently, were sincerely proud of the preeminence of the Fatherland in the exploration of space are now sincerely indignant that we are throwing millions to the wind instead of buying abroad products, goods, medications, and technologies for the economy.

It's as if space doesn't operate in the economy. But it does. And it has. It's just that we customarily preferred to not announce the returns of that work. The curtain of secrecy obscured even those things that it was ridiculous to obscure.

Yes, Nikolay Yegorovich Dmitriyev and his colleagues launched satellites and spacecraft that were military. They flew and performed research that was also military. Yuriy Gagarin, German Titov. But let's judge sensibly. Who, besides them, could accomplish work that was improbable for its complexity, work that required the strictest supervision and the highest quality of execution?

It wasn't just Dmitriyev who slept no more than an hour or two a day just before a routine launch. It wasn't just Dmitriyev who examined his "field" millimeter by millimeter, endeavoring a thousand times over to ensure that not the tiniest mistake had been made. And then here was a typical detail! Nikolay Yegorovich personally sent several dozen satellites into space. On only one of them did something "go wrong" during flight. Only one. Out of several dozen. And that was something that was virtually impossible to predict, something that had nothing to do with the technical launch director.

And do you know how, in those cases, the "depth" of the problem was plumbed? Everything that had even the slightest thing to do with the satellites and its gear was studied. Right down to the composition of the ore from which an alloy was founded.

Who can do that sort of thing, besides specialists with the highest level of training in military uniforms?

Of course, we could discuss to the end of time why it is the army that has absorbed the best of the scientists, engineers, and people entirely civilian who are forced to work in a military department not out of love, but duty. But in that very department were and are a good many military specialists who are in no way inferior to their colleagues from the "civilian world" in terms of training or intellect.

Take Dmitriyev. It was only an accident that for a long time he was not released to study in the academy and that just when he was released, a department of space electronic systems was opened in the Mozhaysk Academy. But his training period in 1961 at the Baykonur cosmodrome was no accident, nor was his participation in the preparation of the surveillance satellites. There was nothing accidental about any of the work he did for space, which spanned many years.

For space? It's more like for us. Many of us may or may not know why it is that when we turn on a switch, a light comes on or a television or radio receiver begins to work. But we couldn't even imagine our lives without electricity. It's the same with space. We may or may not know that dozens of satellites are flying up over our heads. But we use satellite communications as if it were something perfectly natural.

And what about the abundance of various kinds of information that bombards us every day? Every hour? How much of that information do we get thanks to work in space?

Dmitriyev feels certain that it is simply ignorance, simply shortsightedness that serve as the basis for anti-space remarks. Not a single civilized state could imagine its progress without the development of space systems. By far, not every state is capable of tackling complex problems with its own resources. If only because not every state has its own launch systems. In which case, they run for help—which, of course, is profitable—from other countries. Ours included.

We have quite a few launch systems, and various kinds. And the United States is getting ready to use our services. It's profitable for them in a unique way.

The fact is that for a long time we and the United States, according to Nikolay Yegorovich, were dominated by a unique ideology: we fought for the creation of reusable systems, thinking that reusability itself would be capable of lowering the launch costs. Experience has shown that that is far from the case.

The number of factors that affect reusable space systems is so great that colossal amounts of money have to be spent on restoration operations after the systems return to Earth. Expendable systems, which we assemble on a line have turned out to be cheaper. An old principle is at work there: the more products, the cheaper they are. So that we can actually make a profit.

It's a pity that, essentially, the thought never entered anybody's mind in the pre-perestroika period to market our capabilities. Indeed, why would anybody have such a thought? The state was financing the military department generously, and there were plenty of systems for space. Small programs were developed, as were large ones, like Buran. Now the finances have been cut back sharply. And if they're cut back more in the future, Dmitriyev feels that not only will we not take new steps in the exploration of space, we may even lose what we already have, what we have managed to achieve over all these years of work in space. It would be easy to lose. Much easier than imagine several prominent critics of the "ruinous" space activity.

Why the skid? Didn't conversion get off to a good start? It's not just from the habit of rushing to the gun ports without thinking about whether we need to be rushing to the gun ports.... One thing is we haven't thought out our steps in that regard. Another is that those steps are still uncalculated. And without calculations, where do you end up? In ruins.

Dmitriyev and his defense colleagues are very concerned about the decline in the quality of military products. That is a direct consequence of, to put it mildly, a not very in-depth analysis of the conversion plans. How can we put a halt to the destructive processes that are ever more clearly gnawing at the defense sector from within?

"We're destroying the old, without creating the new," says Dmitriyev, "and therein lies our great misfortune."

The reserves general doesn't wish to watch that misfortune from the sidelines. It would probably be easier to just give up on the break-down and discord that is coming about, console oneself with the thought of having done dozens of years of truly conscientious work, and even devote oneself to a well-deserved vacation—it would be a well-deserved blessing. But when it became possible for products developed by the military in the field of space to be used in the national economy, Dmitriyev and his coworkers and friends set up the Kosmo scientific-research center. The aim was simple: to preserve for the country, which has been plunged into a quagmire of political and economic crisis, that which has been and continues to be a point of pride—its space capital. Capital in a literal sense and in a figurative sense. It wouldn't be intelligent to allow the gigantic investments that have been made in the exploration of space to be lost. And, alas, lost they could someday be, in the opinion of Dmitriyev.

Our fairy tales have a much higher level of fantasy than do Andersen's, or anybody else's, for that matter. The wonderment is great: poor Zolushka becomes a magnificent princess! But what would you say about the generals who, in the age of perestroika, become merchants. If you look at that closely, it has its own logic obeying time and circumstance. But Nikolay Yegorovich cautioned me not to think that that's happening out of any particularly egoistic motives or a desire to stay afloat at

any price (although I personally don't see anything at all bad in that: we have to live, and it's not so bad to live a little better). People who are forever loyal to the idea of exploring space and who have given the best years of their lives in the service of space are just trying to save their FIELD. We would all do well to have just a tiny bit of that kind of loyalty, that kind of self-sacrifice, that kind of self-giving and readiness to preserve what can be preserved and, in their opinion, absolutely must be preserved.

The generals are learning to trade a space commodity—services, which are needed not only by domestic consumers, but also by foreign consumers. They're engaged in a very complex affair—they're making their meager contribution to the creation of the new economic field that is and will be needed by the republics who are ready to make their jump. It's absurd to think that we could just up and privatize Baykonur, after making it the property of just Kazakhstan. Just as it's absurd to think that each of the former republics, now independent states, will be in a position to handle "its own" space problems alone. No, no matter what is said, space, like the sky over the motherland, is indivisible. Together, we have created a space industry, and to maintain it, together, is for the common good. Doesn't our universally traumatized ecology alone count for a lot? After all, space is also working for the solution of ecological problems.

I met with Dmitriyev for the last time after he had returned from an important presentation given on the occasion of the founding of the Moscow Regional Chamber of Commerce and Industry. The general director of the scientific-research center Kosmo became a member of the board of the chamber. Dmitriyev will work very closely with entrepreneurs of all kinds to create a fundamentally new structure capable of consolidating bankers, commodity producers, and so forth into one economic body.

Dmitriyev has greeted many a New Year here at Baykonur. That's something, I guess, that is celebrated in Moscow. Those things hardly make their way to Kazakhstan. But they are linked to Baykonur, one way or other, such that the thoughts and spirit of Nikolay Yegorovich are, in a sense, there [in Moscow].

The cosmodrome started from nothing. The steppe. Yellow tulips, whose lifetime is so short.

A solitary mushroom on the banks of the Syrdarya. An attempt to give an uncomfortable shore some resemblance to a resort.

And those elegant streetlights, with the light benches—an attempt to civilize the dull cityscapes. Yuk, that gray architectural standard of ours! If it weren't for the various space structures, who, tell me, would every guess that Leninsk is the space capital?

But it's another thing, those "towers," which can be seen from far, far away. And the maintenance rigs that so

carefully support the streamlined space bodies of the rockets, beautiful in their simplicity and consumateness. Do you see the stars in the photo? [Photograph of maintenance rig, not shown here, with stars pasted onto framework.] A new little star appeared after each launch. When the number of stars reached several dozen, each new star began to designate not one launch, but 10. There wasn't enough room left on the rig, so what could you do? One unit, i.e., launch pad No 1, saw more than 300 launches!

These are incredibly nervous moments. In another instant, the "petals" of the supporting structures will open up, and what was created by human hands will roar upward, into the cosmic expanses. How did Gagarin put it? "Let's go!"

Such moments make life worth living.

Roundtable on Space Program Status, Future

924C0434Z Moscow *LITERATURNAYA GAZETA*
in Russian No 4, 22 Jan 92 p 12

[Article by Andrey Tarasov, under rubric: "Club 206:" "Into the International Space Year on the Fragments of the Space Program?"]

[Text] **We Have Created an Industrial Monster Within the Confines of Russia. Should We Leave a Nuclear Power Station Without Communication? Satellites That Have Been Paid For But That Are Not Yet Launched Are Lying Around on the Ground. "Buran" Is Ready For an Explosion.**

The antispace moods in the streets and kitchens, in waiting lines, and even in parliaments have almost matched the anticommunist ones. The space program has been declared to be the favorite child of the totalitarian system. But whereas everything in that system turned out not quite right, we still have electrification, land reclamation, chemicalization, mechanization, and other beneficial undertakings.

Finances are breaking up, and a large number of hands are reaching for the stopcock in the space program. But the stoppage will not mean the cessation of a flight by two or three people, the dismantling of "Buran" into slabs, and the rejection of the cherished Mars dream, as many people still naively assume.

Our space program consists of 175 apparatuses in orbit around the earth and 30 satellite systems (14 military). In 1990 we launched 76 satellites, and in 1991 approximately 60. In terms of payload, that came to approximately 500 tons a year. Our space program also includes 11 ground points for receiving and processing information, and ships in the instrumentation complex. It includes three space centers, approximately a thousand enterprises, KB [design bureaus], and institutes with approximately a million workers.... And 80 percent of this science-intensive potential is in Russia.

What is going to come crashing down onto our heads if we stop the space-rocket flywheel? On the other hand, exactly what is its KPD [efficiency]? Is there even one citizen who can imagine clearly and intelligibly what his annual space tax is being used for? The budgetary draft for the new year (the acceptance of which will still require a fight) costs each inhabitant approximately 35 rubles, with a total of 7 billion. That is at the level of past years, but what did that total amount of money turn into when the prices were freed? In addition, many enterprises at the end of the year did not receive a single kopeck for about three months. The most treasured components in the complex—its efficient, well-trained people—are beginning to leave the complex, never to return.

But the most improbable thing is that it is completely uncontrollable! That is the overall conclusion of the Russian government's working group on the space program. The working group was created by the initiative of the Moscow Space Club, which has united cosmonauts, scientists, engineers, and journalists for the informal discussion of the problems of the space program (roundtable moderator from the MKK [Moscow Space Club], S. Golotyuk). Here it is possible for the chief designer and the rank-and-file designer to meet on equal terms, without any "carpets" or reception rooms. People can shout wildly at one another and they can share ideas, which, I hope, will not lead in the future to a paper stream of explanatory notes. Today we have gathered at "Club 206," the name of which is derived from the number of the conference room at *LITERATURNAYA GAZETA*.

V. Postyshev, Moscow Space Club expert, member of the International Space Law Institute. The space program in the Soviet Union is practically the only branch that did not have its own agency of single administration, of the type of the Ministry of Railroads, the Ministry of Civil Aviation, etc. At the same time we were the only space power that did not have its own space program "ministry," although such agencies exist in practically all countries, including the developing ones. At the present time it is already clear that Russia must have its own space agency. We need professional measures to reform the space program. We need an efficient dialogue with the civilian society, and civilized communication with the parliament. But at the present time it is impossible to understand how the administration of that branch was organized.

USSR Minobshchemash [Ministry of General Machine-Building] has been scattered—not yet into smithereens, but into some kind of tremendous fragment under the name of the "Rosobshchemash" [Russian General Machine-Building] concern. It has included all the space-rocket enterprises, but not the great "Energiya" [Energy], which preferred sovereignty. Yuriy Koptev, the first deputy minister, became the vice-president of the space concern and proved to be not indifferent to the department of general machine-building in the Russian Minprom [Ministry of Industry].

Yu. Koptev. We said: there used to be a space monster, but now we have created within the confines of Russia an industrial monster, we have gathered there 23 branches and 29,000 enterprises, and we want to decide at the department level those questions that ought to be decided at the level of the President of Russia, at the level of the highest state legislative authority.

Interruption. Bowing down to a ministerial department after substantial negotiations in the impenetrable offices of the BPK [military-industrial complex], in the departments of the TsK [Central Committee], and after hearings at the Politburo is truly offensive. The level has fallen, and state attention has also fallen. But is it only a matter of vanity and pride?

Yu. Koptev. The space activity of any country has so many areas of specialization, is so multifaceted, that there is practically not a single area where it has not made its appearance. Today it would be inconceivable to organize even foreign policy and the disarmament processes with the appropriate monitoring with the aid of space equipment. If one takes the decision of certain social programs that are linked primarily with the providing of information concerning our society, we are all well aware of the situation that we are in today, and of the specifics in Russia that are linked with its geography. The lessons of the Persian Gulf demonstrate that it is mandatory for a country that retains its nuclear-missile potential and that is one of the guarantors of peace in the world community to have an information system. This consists first of all of observation means, and the transmission of information. So France, Italy, and Germany have made the decision: taking into consideration the results of the events in the Gulf, they are creating their own space observation systems...

Communication is one of the whales in the information system. Out in the lobby, Mikhail Yelizarov, deputy minister of communication in the Russian Federation, just complained that our communications satellites cannot compare with foreign ones, either from the point of view of their service life or the number of communication channels. But it is possible in general to remain even without that. What then?

M. Yelizarov. In order to provide one television program to Yakutiya, it is necessary to spend 1.5 billion rubles for the ground equipment. That is in market terms. Yakutiya occupies 3 million square kilometers, and Russia, 18 million. Consequently, if we reject the space program and switch over to ground equipment, we must spend hundreds of billions of rubles. For such republics as Russia and Kazakhstan, there is simply no other way out. And if, in 1992, three satellites out of 11 are not renewed (that is, replaced), half of the television viewers will be unable to receive the first program on their television set, and more than half will be unable to receive the second program. Thirty-six printing offices will stop producing newspapers. Nine million channel-kilometers are being used for communication. And those channel-kilometers are such that are absolutely necessary

for life under present-day conditions. The nuclear power station at Bilibino is supported from space. Leaving a nuclear power station without communication.... That would really be fraught with....

Is there such a danger?

M. Yelizarov. Definitely, if we do not renew the "140-degree" satellite that will have to be replaced at the end of the year. They'll switch off that communication....

But have the necessary production orders been made? What are the mechanics for this?

M. Yelizarov. The production orders have been made. They used to be made to the former Minobshchemash, but currently they are made directly to Academician Reshetnev's Krasnoyarsk Association.... But we need funds to pay for this equipment. The renewal of these satellites used to be paid for out of Ministry of Defense funds. Now we have begun purchasing satellites ourselves. They have a large number of satellites that are for purely military purposes, but we have an incommensurably smaller number. So we ourselves must go to the president or to the government in order to get the funds. But where is that access to the president or the government? I feel that the Russian Space Agency under the president must be precisely that link that will make it possible even before the Supreme Soviet to defend the extremely necessary programs. Not some corporation, department, or association there (currently dozens of them are being created), which can never see either the president or the vice-premier....

In general, of course, there was a chief customer for the space funds. The chief one, but an unpublicized one that, for all the past years, hid behind the narrow shoulders of the Academy of Sciences. The Ministry of Defense, in a certain sense, it is said, served as a model of discussion of its space programs at various levels, such as: the MO [Ministry of Defense] Scientific-Technical Council; the Armed Forces Military-Technical Council under the chairmanship of the chief of the General Staff. Major General Yuriy Gusev, deputy chief of the space means of the Strategic Deterrence Forces, feels that this "shelved scheme for the formation of programs for military and dual purposes can prove to be beneficial also for the Russian Space Agency if that agency will be created." But was that scheme always irreproachable?

Yu. Gusev. Questions, say, of hydrometeorology, cartography, and navigation used to be discussed with the participation of representatives of the civilian departments, industry, and the Academy of Sciences. But standing above all these was the well-known military-industrial commission and the party apparatus. The final decisions, of course, were made by the hierarchy and frequently did not take into consideration all the opinions.... There were elements of duplication. Certain programs of mass consumption of resources and funds were carried out to the detriment of others.... If a single state-wide program had existed, it would have been

possible within its confines to engage in a more precise redistribution of funds to other elements than "Buran."

Are we really supposed to believe that even the Ministry of Defense was "bent down," and was forced to order a squadron of "Burans," "an adequate response" to the Space Shuttle, which "Burans" now have been basically rejected, dashing onto the sandbars many thousands of collectives at the narrowly specialized KB and plants? There was, however, a force that is breaking that shaft! But upon hearing the word "Buran," Yuriy Semenov, the general designer and director of the "Energiya" NPO [Scientific-Production Association], which is the lead one in the piloted programs, winced. Recently he has accepted a rather large number of blows from his critics: for the gigantic excesses of "Buran," and for the "Mir" [Peace] program that has been dragging along as an excessively long construction project and capital repair. But he showed his character and came to the "lair of the press" in order to conduct a dialogue.

Yu. Semenov. Previously we did not like the structure. Previously we didn't like the programs. But today, when we have criticism present, there is no program and there is no administrative structure. But if you see what is being done abroad, you will find that the programs not only of the United States, but also the European Space Agency, Japan, and even China, are a complete repetition of what we are criticizing. Both the orbital stations with means of supply, and multiuse systems. Take, for example, the "Energiya-Buran" program. The American program went down a blind alley only because it does not have a booster-rocket as heavy as the "Energiya." So the Americans today are using every wily means to buy our engines, in order to renew the Space Shuttle research and development.... People in the United States, in general, are struck by the optimal nature of our orbital-stations program. Moreover, it is possible that, farther along, we shall the beginning of a discussion about their being ready to subsidize the program for a "Mir" station, for its annual maintenance.... I might add that the "Energiya" program is another one one that has gone down a blind alley, because the future belongs to large orbital communications platforms. Even the European countries are talking about this. The only country that has this kind of booster at its disposal is Russia. Maybe this program will snatch way the funds that are necessary for "Gorizont" [Horizon], but that is a program for the future....

It turns out that it is desirable to tread on the painful corn of finance, as irreconcilable contradictions arise in the well-ordered space ranks—even among those who have been working side by side for decades.

V. Aksenov, general director of the "Planeta" [Planet] NPO, USSR cosmonaut-pilot. Everyone present here has presented his trends—military, piloted, etc. I present monitoring of the environment, a trend that is one of highest-priority and most necessary ones in the world, and in all the space countries. These include America, the European countries, and Japan. It is only in our

country that that trend continues actually to be based on residual financing. For three years we have had 40-percent support from the small planned amount of 140 million.... The system of study and efficient use of natural resources is practically going out of commission. This is the loss of monitoring of the ecology, emergency situations, Chernobyl, and the consequences of natural calamities. Satellites that have been paid for, but that are not yet launched, are lying around on the ground. There are still a lot of them, and we can forget those systems. Then we shall begin to use the information from American satellites, paying \$600,000 to lease just one receiving station. Or, we can fail completely to get that information. In that instance, we will not have any meteorology, any monitoring of the natural resources.... We shall close the question of our participation in the study of the environment. But it is precisely this trend that will provide a conventional economic benefit that is seven to 10 times greater than the expenditures....

Yet another sacrifice of the residual principle in the space program is fundamental science. It would seem that one ought to begin with it, deciding where to fly and then to fly, but the academy representative here too is modesty and long-suffering itself.

A. Alferov, academic secretary of the Interdepartmental Scientific-Technical Council on Space Research. There is, of course, a scientific program. But here is the problem: the financing of that research proceeded from three sources. The creation of scientific potential proceeded through the Academy of Sciences; the creation of space technology, through Minobshchemash; and finally, the GKNT [State Committee for Science and Technology] provided only specially earmarked funds for scientific apparatus for the Mars program.... The difficulty consisted in harnessing together these three sources, each one of which had its own tremendous tasks, and, as a result, since 1989 our program was so cramped that right now we cannot continue the operation of the still completely usable "Granat" [Grenade] X-ray satellite, that provides unique results, and the international collectives that are attempting to cooperate with us on the most vitally important problems are being scattered....

Who, then, will be judge, and what will be the measuring stick when dividing those financial crumbs that the country will be able to allocate to the space program?

I. Moiseyev, Moscow Space Club expert. If we throw 800 million into a "Buran" that is not operating now and that will not start operating in the future, we will pull funds out of the space program and kill the national-economic systems....

Yu. Semenov. No, that's incorrect. If today we do not maintain within the confines of "Buran" the reliability of the engines, we shall not complete the development also of the world's most advanced rocket, the powerful "Zenit" [Zenith]. We cannot fly on it today, because at one time money was saved. For the time being, it is better to put 80 million a year into the maintenance of

reliability, rather than blow up two launches, one after the other, and then rack our brains about how to restore those launches for a half-billion.

Yu. Koptev. Thank God, we have been flying on "Soyuz" rockets for more than 30 years, and, whether or not we want this, we must somehow collect ourselves and transfer to the "Zenit." Life will force us to do this anyway, because this kind of transfer will immediately give us a ten-fold saving in the area of the fall area. Today no one will take anything from us in exchange for land. Tomorrow they will begin taking money. If we want to continue the development of the space program, we must start running at the resolution of these problems.

V. Aksenov. I completely agree with you. This is one of the most vitally important questions, but it is necessary to work out the kinks in the new rocket not within the confines of the "Buran" program, but on a special-purpose basis.... In general, space programs cannot occur if we orient ourselves on the capabilities and the desire of the manufacturer enterprises. We need final tasks, a clear-cut result for the sake of which we are working.

Yu. Semenov. You understand that a very unique infrastructure of ground complexes has been created, a testing-ground base in which, without doing anything today, it is necessary to invest 400 million a year. Or for the Supreme Soviet or the president to make the decision to blow all of this up. Together with the 14 billion funds already invested. Whatever system of administrative fiat or whatever politburo produced this, it's a reality! I am profoundly convinced that in the twenty-first century the most popular output will be made by the space industry, and people will pay billions for it, and we are moving toward it. That's what we are talking about!

How, then, do we decide for "Buran": is this the future of progressive mankind as a whole or is it a bear that will not release the hunter who has caught him? The opposing sides that are shouting themselves hoarse agree about one thing: we need a space agency, a state agency under the president that has at its disposal an independent group of experts to select from among the competing, or at times opposing, plans, and to set up a uniform state program that is blessed by the chief of state. Today, in LITERATURNAYA GAZETA'S "Club 206," the passions have also been addressed to the legislators. It is to them that an ardent plea is made by Aleksey Adrov, deputy to the Russian Supreme Soviet, and chairman of the Commission on Transport, Communication, and Information Science. It is curious that he was elected in the Moscow suburbs of Podlipki, within the walls of the "Energiya" NPO, but from his very first words he demonstrates an independence of thought.

A. Adrov. We used to have the structure of the VPK, the Ministry of General Machine-Building—single, indivisible, and general. Then we arrived at the situation to which we have come. It seems to me that the old structures are afraid of creating something new that will

remove from them the function of forming programs, of distributing money, and the choice of a customer on a competitive basis. Therefore they are hindering the creation of such an agency.... As a result we are sitting around without any prepared recommendations with regard to the budget. But the question has become so acute that even those structures realize that this situation cannot continue any further. I think that within the near future there will be ukases signed by Yeltsin concerning the creation of the appropriate agency. There exist programs that the state must finance. But if it cannot do something, the companies must realize that there is no financing here. The next step is to confirm to those enterprises where the programs have been closed that not a single person will be fired during the next year and a half or two years, and that people will continue to receive their wages. But that deadline must be clearly limited in order to convert the capacities. This is a rather long period of time to determine one's fate. What it is necessary to finance now and what is not necessary is the subject of serious research that must be carried out openly and objectively. That is, the nation must know how much it is paying for what programs, and what those programs will provide.

The participants in the roundtable did not come to an agreement about everything. What if, after a year and a half, or two years, an enterprise that has had its area of specialization changed has to be returned once more to the bosom of space? And where will the perplexed ballistics specialists, endurance specialists, and designers be? Where will the unique base be? Gathering them and training them would mean new billions!

The argument was parried with an ease that opens up, perhaps, a curtain into tomorrow's happier space science.

A. Adrov. Throughout the world, a production order for the manufacture of space technology is advantageous. Therefore, if, in a year or a year and a half, a production for developing a particular unit, a particular assembly, a particular satellite, is announced, not only will there be a desire at the "Energiya" NPO to accept it, but there will certainly appear other companies that will want to get that production order....

Despite the difference in positions, age, work experience, and even the certain heat in the discussion atmosphere, most of the participants proved to be co-authors of a general report on the situation and the reorganization of domestic space science, which report will be sent in the name of the working group to the Russian parliament. Now it is up to the parliament.

Uncertain Future of CIS Space Program

*927Q0067A Moscow PRAVDA in Russian 17 Jan 92
p 3*

[Article by Vladimir Gubarev: "Where Are the Boundaries in Space? We Must Now Answer This Question"; the first two paragraphs are an introduction]

[Text] Soviet hucksters, like cockroaches, have run through different cities of Europe and Asia, at a low price offering to foreign buyers all kinds of Russian items in short supply—from soup to nuts. However, it must be confessed that this business has gradually slacked off and the buyers are already demanding something different, more exotic. And they say that in the famed bazaar at Istanbul it has already happened that our hucksters are beginning to offer both automatic equipment and guns and enriched uranium and even missiles of the “surface-to-surface” class.

It seems that even the Mir orbital system has come to this point.

The leaders of the Energiya Scientific Production Association have hastened to refute reports on the Mir sale. They say that these are fabrications, but right now new information has arrived: there is no money to continue research in orbit and the remaining resources will last for three months at most. And then? The Minsk meeting of the leaders of commonwealth states had calmed things down a little and a resolution was adopted on the joint financing of cosmonautics, and this means that the agony of the space system will last a little longer. We should have no illusions: after some time very acute financial problems will arise again, and who knows whether it will not be necessary to ask for humanitarian assistance also for the cosmonauts who are working in orbit.

The crisis in cosmonautics is continuing to develop and for the time being there is no light on the horizon. It is possible that we will be forced to set a big period after Soviet cosmonautics, symbolizing the end of our “space era,” which opened so brilliantly.

I know one thing: neither the cosmonauts, who are honestly performing their duty aboard the station, nor the specialists at the Flight Control Center and the cosmodromes, nor the thousands of people developing and fabricating very complex modern equipment, have any relationship to the crisis. They are only victims of that space policy which has been carried out for decades.

A great many slogans sound from the pages of the press. Such as “Space in the Name of the Earth,” “Space—an Infinitude of Power and Mountains of Bread,” “Space Achievements are the Achievements of the People,” and so forth and so on. We have been uttering these slogans now for more than a quarter of a century, not noting that with each passing year they deviate more and more from reality, not being transformed into specific results, but into invocations in which few believe.

What are cosmonauts doing in space? What is the work program for the coming year? What do we achieve by exchanging one crew for another? Why do we constantly hear about commercial flights and there already have been so many of them that it would seem that this branch is no longer in need of additional financing?

Unfortunately, these questions cannot be answered not only by rank-and-file taxpayers, but even by most of those employed in the space industry. And this is the reason why there has been such a sharp drop in interest in cosmonautics not only among us adults, but what is such a pity, among children, who no longer dream of becoming “Gagarins,” “Titovs” or “Nikolayevs.”

But I remember Moscow going wild after the launching of Yuriy Gagarin.

During the past year, during the flight of the Soviet-Austrian-Kazakh crew, something similar was experienced not only by the Austrians, but also by the inhabitants of Kazakhstan. They were proud of their countrymen and at the same time very clearly understood that study of Aral Sea ecology will at least to some degree help in saving the dying sea and the people living around it.

Unfortunately, today there are very few space programs which are clear, understandable and intelligible to everyone. The departments themselves are attempting to satisfy their own ambitions and interests and therefore cosmonautics, however regrettable it may be, is similar to a gigantic monster, concerned only about itself. And many leaders in this branch do not want to understand: cosmonautics will avoid collapse only if it has public support. And for that reason the goals and objectives of work in space must be understandable and clear.

For example, the “Space-Children” program was born. We have written much about it and therefore I will not delve into the details. The main idea is to attract the attention of the upcoming generation to cosmonautics, to make an attempt to see to it that any small child in one way or another would be drawn to it. So what happened? The “Space-Children” project was supported by the president of the United States G. Bush, the president of France F. Mitterand and a number of public figures and entrepreneurs in the West. The project has interested many of our organizations, but specifically those which are far from space, whereas the “pioneers of the universe” have only smiled ironically: they say that they have no time for such things....

Or another project: “Ukraine-Space.” It was born during a space holiday transpiring in Kiev. An organizing committee was established; an extensive program of biological and ecological research related to the consequences of the Chernobyl accident is being drawn up; both scientific and entrepreneurial structures are actively participating in working out the flight program. L. Kravchuk sent a letter to M. Gorbachev, president of the USSR, in which it was requested that attention be given to this project. In particular, in his letter he mentioned that at the Cosmonaut Training Center preparations are being made for the flight of Ukrainian specialists and the journalist Yuriy Krikun under the “Space-Children” program. An interesting proposal, is it not? There is even talk of financing of such a flight not at government expense, but by public organizations and enterprises.

And what is the reaction? Once my telephone rang and one of the directors of the space department asked that we drop our journalist-candidate from the cosmonaut detachment, saying that "this would favor development of nationalistic feelings in cosmonautics" (!). Incidentally, no answer has yet been received from the letter of L. Kravchuk, although a long time has passed....

It is gratifying that the Commonwealth members agreed "not to draw boundaries in space," but through joint efforts to develop further this field of human activity. But today boundaries are not being drawn between states, but within cosmonautics itself. If the old approaches remain, if there is no broad public discussion of immediate and long-range programs, and finally, if companies and departments, as before, do not give heed to public opinion, the crisis in cosmonautics will become irreversible.

Political Factors Said to Predominate in New Space Policies

927Q0069A Moscow MOSKOVSKIY KOMSOMOLETS
in Russian No 10, 17 Jan 92 p 4

[Article by Ravil Zaripov: "Lemons for the Funeral Repast, or Space 'Games' of the CIS"]

[Text] 1992, which we have now entered, has been declared the International Space Year. Ten years ago this UN resolution would have been seized upon in our country with joy and would have been transformed into a large-scale campaign. After all, we are the pioneers of space. But as might be expected, the burst of space euphoria was short-lived and evaporated in the bread lines.

It's paradoxical. Overcoming space and the elements, we nevertheless displayed to the entire world our bankruptcy, the incapacity to make the dream a reality.

What Will the International Space Year Be Like for Our Cosmonautics?

Will it not turn out that precisely in this year the manned cosmonautics of the former USSR will cease its existence or be put on the shelf for an indefinite period? The question is not rhetorical. With the general collapse of the economy space programs are dragging very significantly. For the time being they are being laid aside, postponing what was intended for an indefinite time. But these times have their limit and the formula proposed by the poet—"running in place has an overall strengthening effect"—is not applicable for science.

It is not fitting to speak of the global financing of space experiments. Money does not suffice at the level of daily life. The request of the preceding space crew (Anatoliy Artsebarskiy and Sergey Krikalev) that several lemons be sent to the station by freighter turned out to be a real problem.... It goes without saying that there were none in the state stores and how to pay for them on the open

market? The money allocated for acquiring food products did not suffice for the purchase of even one lemon. A solution was found in the prophetic phrase of Ostap Bender: "Foreign countries will assist us!" The Austrian cosmonaut Franz Viehboeck, making ready for flight, visited the foreign exchange store and from his own pocket solved the space problem of the country of soviets. There is no reason to be surprised at this. And the document concerning the possible loss of the Mir space station, which is no longer secret, looks sensational only at first glance.

In accordance with the traditions and norms of Party life, the Mir space station was launched on the eve of an upcoming congress. In February 1992 it should mark its sixth anniversary, a pretty long time for a space object. As it became known, the 100-ton system—the Mir station and the Progress freighters—will scarcely fall into the bosom of Poseidon this year. The lifetime of the station has been officially extended to 1995. How to explain such a long lifetime despite a constant shortage of resources? Scientific necessity? Without question, the history of the station includes more than a few world-class developments. But in my opinion the main reason lies in the political sphere. Precisely from this was born the Minsk agreement of states—members of the CIS, on joint activity in the exploration and use of space and the decision to organize an interstate space council.

Cosmonautics and Policy in Approximately Equal Portions Were Closely Intertwined With One Another

Political ambitions moved space science. Today the emphasis has shifted. The proclamation of independence and all-embracing declaration of sovereignty require demonstration not only on the land and at sea, but even at the altitudes beyond the clouds. The desire of political leaders to have in the former union, autonomous republics, krais and oblasts their own "domestic" cosmonauts will be manifested more and more clearly. As will the desire to share in the space property of the former USSR, and to be more precise—the Ministry of General Machine Building. But how will the independent states "spread" among themselves the 154 satellites revolving in orbit is a mystery. Science will be the loser in such "games."

And nevertheless we will be realists. The sovereign flight of a Karakalpak cosmonaut, if it takes place, will be in the distant future. Prestige is an expensive satisfaction and those will be in control whose wallets are a little bit thicker and whose muscles are a little bit stronger. Until recently, according to estimates of specialists, the operation of the Mir space system was financed with the following participation by percent: Russia—more than 50 percent, Ukraine—about 40 percent respectively. The remainder was divided among the other republics. For the time being it is unknown how the states, the CIS members, will reach agreement on further financial obligations. (They have not done so. They are thinking about the army and prices.) Preliminary estimates show

that the 200 million rubles allocated for the year will suffice only for the first quarter.

Meanwhile Leonid Kravchuk, president of the Ukraine, has his mind firmly made up and by the end of the year plans to put a Ukrainian crew into orbit. He invited test pilot Aleksey Kadenyuk to be the ship commander and the journalist Yuriy Krikun to be a researcher. The two are undergoing training at Star City.

Yevgeniy Paton, president of the Ukrainian Academy of Sciences, hopes that the space program of the republic will look worthy. As they say, we'll wait and see. But for the time being we are listening to the opinion of Anatoliy Artsebarskiy, commander of the preceding space expedition. I remind you that on 4 October 1991 he and Sergey Krikalev were joined by an international crew made up of the commander Aleksandr Volkov and two cosmonaut-researchers: the Kazakh Toktar Aubakirov and an Austrian citizen, Franz Viehboeck.

"The proposed Ukrainian flight will transpire to a high degree as a political action. To be sure, I would like to see serious scientific research, but it is impossible to prepare for it in such a short time. Speaking frankly, there also was little science on the Kazakh flight. Yes, for the public this all looked beautiful, convincing. But for specialists it was evident that many experiments were taken from preceding programs and on this flight only new names were involved."

There is Still Another Reason for the Appearance of a Space Agreement

In its time the former USSR took on itself international obligations in the field of joint investigation and use of space. On 17 March 1992 plans call for the launching of a ship in which a citizen of the FRG should fly together with our lads, Viktorenko and Kaleri. In August plans call for a joint flight with a French cosmonaut. As I learned, an agreement has already been signed on a second Russian-German flight.

It is fitting to ask the question: what do we gain from this other than, so to speak, inviolable friendship? Expressed in monetary terms, each such "excursion" lasting a week costs the foreigners about 10 million dollars. Is this advantageous for us? This question is open because the it is necessary to include in the expenditures not only the cost of launching of the ship, but also the contents of the station itself, maintenance of its operability, etc.

Well, what about the scientific aspects? During the last international flight the Austrian participant for the most part carried out medical experiments. In collaboration with the Institute of Biomedical Problems Austrian apparatus was used in studying vestibular and cardiovascular deviations of the cosmonaut during the time of flight. The program for the cosmonaut from the FRG also provides for emphasis on medical research within the framework of the objectives of the European Space

Agency. But, as our specialists say, the German side is not inclined to lay all the cards on the table and share the research results with us.

So that such flights for the most part have a political character.

Between Space Science and Policy the Scales are Obviously Tipped in the Direction of the Latter

But it would be incorrect to rush to the other extremity and engage in self-flagellation, quite often running down our space research. Work is being carried out in space in five principal directions: testing and improvement of space technology; space photographic surveying; mastery of space technologies; astrophysical research; medicine.

Not all these directions are identically strong and equally undebatable. Our cosmonauts are taking photographs of the Earth's surface with the highest reproduction quality. They enjoy great demand in the world market. However, as Solovyev said to me: "I completely fail to understand why we are concerned with astrophysics. The only thing that I have been able to learn from scientists is that by observing processes in stars it is possible to economize on or entirely do away with nuclear shots." In the mastery of space technologies with the fusion of crystals there have been positive results. But as the cosmonauts themselves feel, it is still too early to shift this process to an automatic mode without man's monitoring and it would be equivalent to throwing money away.

A fourth generation of life support systems is operating on the station. One of them is a unique debugged system for the generation of water from the station atmosphere. The condensate is saturated with salts and can be used for the needs of cosmonauts. Here it is fitting to note that American scientists only recently developed a similar system. And although they are faced with painstaking work for "seeing it through to the end," they regard the development of such a system as a great scientific achievement.

Our most important recent success is the development of a space construction element: a 15-m beam in open space. This unique structure has been entered in the Guinness Book of Records. The mast, mounted perpendicular to the station, weighs only 80 kg and is capable of supporting a load of 1.5 tons.

But even having this unique structure, we have not been able to break into the world market. No one is intending to yield us their place or even be squeezed in the space business. If you want this you have to fight for it.

The widely advertised joint Soviet-American program for flight to Mars has seemingly disappeared into the shadows. Judging from everything, the Americans are planning to make this flight independently. Information recently appeared indicating that the Americans might purchase the Mir station from us. A version is circulating among the cosmonauts that such proposals are not made

from great love or a desire to assist our financial situation. Instead, the reverse is true. This is an endeavor to deprive us of our last trump card, because for the time being no one has our experience in manned space flight.

The Rank-and-File Russian Exclaims: "Cosmonautics, Patriotism, Achievements (Which Help No One)... but Nothing to Fill the Stomach"

In actuality, the mood in society is such that if a referendum was held—"yes" for space research or "no" against it, a high percentage of the population would cast a resounding "no." What are the arguments in its defense? Strictly speaking, they have already been set forth and the words of Vladimir Solovyev, flight director for the Mir station, seem familiar to all:

"I am far from the thought that space will yield dividends. In any civilized society there must be some leading branch. It should be assigned ultracomplex problems and solve them. Assume that these problems are good for nothing. It makes no difference, it may come to that. Indeed, the atomic bomb also was a good-for-nothing project. A leading branch is necessary because by solving complex problems it works out advanced procedures, gives birth to new technologies and materials, and most importantly, a new organization of labor. The Americans, after ending the Apollo program, established an independent commission for the purpose of clarifying what was achieved. They sat for a long time and concluded that the principal achievement was not that man had flown to the moon or had returned lunar ground to the Earth. The Russians returned lunar ground in automatic vehicles, a lesser quantity to be sure, but cheaper. The most important thing was that it was possible to organize an integrated, well-functioning system of thousands of companies located in the United States and Japan. They created a structure operating like a single clock mechanism. And then it was introduced at the Pentagon.

In principle I agree with Vladimir Alekseyevich. In creating our space shuttle, called the Buran (the Earth to it is down. Evidently it does not fly that way), a great many discoveries were made. But the self-awareness of the rank-and-file citizen has long been worn down by lines, prices and the absence of this and that, and he absolutely does not wish to believe in the "wonderful distant future." In his way this citizen is right. Who is willing to give up everything to wind up at the end of life in "agonizing pain"? Bringing to mind this same Buran, it is possible to recall the special glue which was developed by which the "shingles" were attached to the ship's body. Something I had not heard was that this wonder glue has now been used in furniture, after which there is less breakage. Or in boots, which now wear longer. Indeed this could be not some remote mythical payoff from research on the *Drosophila* fly, but a real assistance to people which each of us would individually feel ourselves.

We Can Wind It Up as Follows

But there is still another extremely indicative feature reflecting the state of affairs in our cosmonautics. This is the pay of the people participating in the development, preparation for and implementation of space research. Among a high percentage of the population there is a well-established stereotype which was formed in the late 1960's; "Anyone who has flown once is set for the rest of his life." I admit that I myself thought that way. But today's reality has proven otherwise.

As a year ago, a half-year flight gives a total pay of 15 000 rubles. In speaking recently with Musa Manarov and Aleksandr Laveykin, I learned with surprise that their salary is a miserable 660 rubles per month. And this despite the fact that Manarov, for example, holds the record for man's prolonged presence in space: one and a half years. And also it is a well-known fact that prolonged space flights do nothing for one's health. Radiation exceeding the admissible dose accumulates in the body, the immune system is weakened and fatigue sets in rapidly. All this lets itself be known with time.

Then CIS Agreement Concluded in One Hour. Has Caused Complete Confusion in Space Ranks

A whole series of problems was left hanging in the air. The "Regulations on USSR Cosmonautics" today has no juridical validity. There is only a directive from Silayev, on the basis of which the Ministry of Defense should tomorrow or the next day draw up an order. This document may possibly answer a number of questions. But for the time being the cosmonaut detachment has made the decision that they will not take a new oath either to the Ukraine or to Russia. Most officers feel: "An oath is taken once and for one's entire life."

Strike Threat by Mir Flight Controllers Described as 'Final Cry for Help'

927Q0066A Moscow PRAVDA in Russian 28 Jan 92
p 1

[Article by Vladimir Gubarev: "Space Strike—A Final Cry for Help"]

[Text] Information that the Flight Control Center is planning to strike could not but cause alarm among all who are in any way involved in cosmonautics. Aleksandr Volkov and Sergey Krikalev are working aboard the Mir. They are awaiting the next Progress, which should dock to the system.

This freighter is already in orbit. It carries not only scientific instrumentation for the impending flight of an international crew, but also supplies of water, food and many other things without which flight of the cosmonauts cannot continue. The docking of the Progress to the Mir, like the flight as a whole, is impossible without the Flight Control Center, where around-the-clock, day after day, month after month, year after year, work dozens of specialists in support of the space expedition. An interruption in the operation of the Flight Control

Center would immediately result in a dramatic situation aboard the space system which could result in tragedy.

Is it admissible that specialists at the Flight Control Center go on strike?

"Quite honestly, I do not know how to strike," admitted the Flight Control Center duty officer. "First of all, I never participated in a strike in my life, and second, today very complex work on the docking of vehicles is in progress and I have my hands full with that...."

In the planning group the answers were more definite:

"A space strike is not what you think it is. This is a cry for help. But today we are working...."

True, it was not possible to clarify what the "nature" of a space strike would be like and how it would differ, for example, from a miner's strike.... And maybe there is no need to look for a comparison. The very fact that the specialists at the Flight Control Center even spoke of the possibility of a strike evokes extremely somber thoughts. It means that they have already reached the limit.

Financial difficulties in cosmonautics have gradually reached a crisis and now have already resulted in collapse. The inflation of prices not only for energy, materials, communication and transport, but even for food products, has transformed the "brain" of our space industry into a center of poverty and deplorable conditions.

The salary of a specialist at the Flight Control Center is 600 rubles. And he has a family and works virtually without days off or vacations, and in Kaliningrad in the Moscow area, as everywhere, the store counters are bare. One gets the impression that everyone has forsaken our space specialists. Yes, documents have been signed that cosmonautics will be financed by all the states of the commonwealth, but there are no real results, there are only words on paper.

On 17 January of this year I wrote about the catastrophic situation facing cosmonautics. It was emphasized that there was an urgent need to take measures, otherwise humanitarian assistance from the West would not only have to be directed to children's homes and hospitals, but also to orbit. Unfortunately, the leaders of the commonwealth countries for the time being lack the time for seriously and carefully discussing the problems of cosmonautics, and most importantly, for assisting people who are honestly and professionally doing their jobs. Is it possible that information about the strike will force other matters to be set aside?

The Progress freighter, due to the smoothly performed work of specialists at the Flight Control Center and the Mir crew, yesterday docked to the space system.

Military Officer Comments on Possible Nationalization of Space Installations

PM0702155392 Moscow KRASNAYA ZVEZDA in Russian 6 Feb 92 p 4

[Reply to reader's question by Lieutenant Colonel M. Arkhipov, senior officer at the CIS Armed Forces Space Systems Directorate Press Service, under the rubric "Briefing for Readers": "Will We Lose Our Television Pictures? Everything Depends on Common Sense"—first paragraph is reader's letter]

[Text] How many satellites are in orbit at present and how long will they stay there if, for example, Ukraine or even Kazakhstan nationalize the space installations on their territories?

[Signed] Lieutenant Colonel A. Shvyrov.

Lieutenant Colonel M. Arkhipov, senior officer at the CIS Armed Forces Space Systems Directorate Press Service:

At present we have over 150 systems and devices in orbit. Military teams preparing and launching space equipment at the Baykonur and Plesetsk cosmodromes, as well as the personnel on duty shifts at units in the Flight Control Center, are still in a position to perform at full capacity the tasks they have been assigned, primarily their national economic tasks.

If the Ukraine nationalizes the three flight control centers, it will be unable to control space communication apparatus in geostationary orbit over the Western hemisphere. In exactly the same way, Kazakhstan (if it were to own the Baykonur Cosmodrome and the only space apparatus control station on its territory) can scarcely control even one orbital station. Actually, it will be difficult even for Russia, given its current financial state, to continue its autonomous space activity. So that, with the "nationalization" of space installations, we may easily find ourselves without a television picture. Incidentally, we do not have to wait even one or two years for this. Everything may be resolved far sooner, bearing in mind that the satellites will not be able to function for very long without contact with the earth and without commands from it.

Economic Crisis at Dnepropetrovsk's Southern Machine Building Plant

927Q0080 Moscow SYN OTCHESTVA in Russian No 5, Jan 92 pp 4-5

[Article by Lt. Col. M. Arkhipov, under the rubric "A Poor Grade for Perestroyka": "Golden Trolley Buses, or How a Unique Defense Enterprise is Being Used"; first paragraph is source introduction]

[Text] The Southern Machine Building Plant Production Association found a place in history as "Yangel's firm" and has been considered for decades as one of the leading, most highly organized firms in the USSR Ministry of General Machine Building system.

Specialists with higher education and first-class workers used to stream here—the wages met everyone's needs. Today, because of the cutback in the production of rocket-space hardware and the general rise in prices, the only people working here are the plant veterans and yesterday's graduates of vocational-technical schools.

The association these days is not just going through hard times—essentially, the issue being decided is whether or not it will continue to exist. Here's what Vladimir Iosifovich Dranovskiy, chief designer of space vehicles, says:

"The plant finds itself in the toughest of conditions. Prices are going up at what is truly space velocity. So that we don't go down the tubes, we also have to raise our prices. There are no more state orders. Deliveries have been interrupted. People are getting miserly wages. It's time to send out the SOS. But will anybody hear it?"

Back in the '80s, guided by the possibilities offered by the Zenit launch vehicle, the design bureau began designing new satellites—particularly the Okean-O—to replace the obsolete, extremely cumbersome satellites used for study of the environment. The new satellites would weigh around seven tons. The cost of the order from the State Committee for Hydrometeorology back then amounted to more than 220 million rubles (R). Nevertheless, the designers set to developing the satellite. But in 1989, the financing of the operations by the client virtually ceased. Today, the design bureau doesn't get even a copeck. The scientific research institute of the State Committee for Hydrometeorology, which assumed the role of client, simply refused the satellite. All that forced the developers to take an extreme measure—they borrowed R50 million from the bank to finish the work. But even that amount of money turned out not to be enough. Which is understandable, because R50 million today is not the same as that amount just a few years back.

The chaos in the economy is putting the design bureau in a bad position. Design and manufacture for a space vehicle can't be "frozen" until better times, like they can be for a new building. And if that same Okean-O satellite isn't put into production in 1992, it will mean that R250 million will have been simply thrown to the wind.

The curtailment of the primary-product output is forcing the design bureau and the plant to search for outside contractual work in order to be able to pay their workers and employees what is more or less just a tolerable wage. However, the outside orders being fulfilled by the association are not at all up to the level of skills of the specialists there. And so people who have spent decades developing space vehicles are leaving Yuzhmash [Southern Machine Building Plant]. You can't hold it against them. They have families to feed. But how are you going to feed a family on 320 "space" rubles?

What is also having an extremely negative effect on the work of a unique enterprise like Yuzhmash is the inadequate level of training among the young specialists who

are coming to the plant from technical schools and institutes. In the shop for assembly of space vehicles, half of the test engineers and electronics engineers are only third-category specialists. Dnepropetrovsk University, which, without exaggeration, can be said to owe its existence to Yuzhmash, recently lowered the level of its instruction markedly. As a result, the engineering graduates newly arrived at the plant are simply unable to do quality work in terms of assembly.

The association as a whole and the individual shops of Yuzhmash are feverishly looking for a way out of this most difficult situation. Take the main shop for the assembly of launch vehicles, where plant veteran Maryan Donatovich Tarasevich works as the foreman. The shop makes end plates and fuel tanks and assembles Zenits and the strap-on boosters for Energiya. But those, its main tasks, have been put on the back burner. The people in the shop, to survive, have begun manufacturing trolley buses—two actual buses and one mockup. For the plant, they will truly be "gold," because the cost of the first will be R0.5-3 million (for the sake of comparison, several years back, a series-production space vehicle cost that much!). You ask, Where do those kinds of prices come from? The answer is simple—only the bodies of the trolley buses are to be produced at Yuzhmash. The engines, the rear axles, the front suspensions, the windows, and the other parts—all of that will have to be acquired on the outside at agreed-upon prices. And in line for production are milk containers, other articles, and even—are you ready for this?—signs and chairs for FRG taverns.

Here's what Maryan Donatovich Tarasevich thinks about that:

"Before, Yuzhmash had an immense reputation in the country. That was because it built the protective shield for the homeland—Korolev's R-1 and R-2 rockets and the famous "No. 5." Dnepropetrovsk production forced the West to reckon with the [Soviet] Union. That's where the political concessions from Nixon, Reagan, and Bush came from."

Today, the Australians, the Americans, the Germans, the French, and many others come in droves to Yuzhmash. But why do they want to get to this unclassified plant? They don't make any secrets of it—they are coming because they want to do business. Although the contracts that we sign with them are generally miserly—like for the manufacture of housings for computers that, in fact, are manufactured in Singapore. But the most important contracts have been signed with China, for the delivery of three rocket engines, and then with the Australians, for the manufacture of ecologically clean automobile brake shoes.

Foreigners are rushing in to use the massive potential of the association. You can't say that about the business people from our own country. They are still rare visitors here. But what's most disturbing is not even that. It's that the infrastructure of space production is, to a great

extent, worthy of much more than the conversion-related manufacture of children's bicycles, signs, and collapsible umbrellas. This unique production facility is capable of giving the country much more. But that's possible only if conversion is performed not in such an elemental fashion, not at the expense of the main thing—the production of the space hardware that guarantees the country the production of high-level technologies and unique materials.

Commentary on U.S.-Russian Space Cooperation

LD1002200992 Moscow Radio Moscow World Service in English 1810 GMT 10 Feb 92

[Commentary by Vladislav Kozyakov]

[Text] In last week's speeches in Paris and Brussels Mr. Henry Cooper who is in charge of America's Strategic Defense Initiative hailed President Yeltsin's proposal for a worldwide antimissile system.

In his view the two countries stand to profit from bilateral cooperation in space research, given Russia's achievements in space-related technologies, such as directed energy systems, neutral particle beams, and power reactors for space application. For their part, U.S. experts say the Russians appear to be ahead in nuclear power systems that would orbit in space and components for electric propulsion units for rockets.

AVIATION WEEK AND TECHNOLOGY reckons joint space research by Russia and the United States could save the nation more than four billion dollars in Star Wars development costs and also help booster the troubled economy of the former Soviet Republics.

However, until recently Washington disapproved of any bilateral deals with Russia involving high technologies. A policy analyst for the Federation of American Scientists said recently that SDI [Strategic Defense Initiative] had been the leading advocate for purchasing Soviet technology more than a year now and that the administration's response overall had been absolute [word indistinct].

Other problems emerge: As work is now in progress to create a global missile defense shield, experts raise doubts both about its effectiveness and expediency. The main argument in favor of such a system is the protection of would-be signatories against a missile attack by terrorist or extremist regimes. Some counts put the number of countries likely to be in possession of ballistic missiles by the turn of the century at 24 at least, which in itself gives rise to a question of whether the establishment of the global shield may not lead to an increase in that number.

One other problem is the continuance of the 1972 ABM [Anti-Ballistic Missile] Treaty. The Americans want to amend it to increase the number of antimissile systems

above what is permitted under the treaty as well as to lift a ban on the testing and deployment of weapons in space.

In the meantime, both Moscow and Washington agree that the ABM Treaty is an important factor of international stability, while the United States Congress imposed a ban on the development of space weapons under an SDI program.

Away from all doubts it is most encouraging that Russia and the United States have begun discussions about a global security system as partners seeking to become allies.

Russian Space Officials Appear Before U.S. Senate Committee

LD2502115692 Moscow Radio Moscow World Service in English 1810 GMT 24 Feb 92

[Commentary by Vladislav Kozyakov]

[Text] Russian and American aerospace officials appeared together at last week's Senate subcommittee hearings in Washington on bilateral space cooperation.

One of the projects under discussion was the possibility of using Russian-built Soyuz spacecraft as a rescue ship for the U.S. space station Freedom in emergency. The idea, put forth by the General Director and chief designer of the Energiya scientific and industrial complex, Mr. Yuriy Semenov, was supported by Mr. Richard Truly, head of the National Aeronautics and Space Administration. He said NASA is most interested in exploring the possibility of adapting the Soyuz spacecraft for use as an emergency crew rescue vehicle for the U.S. Freedom space station.

Other proposals by Russia include renting a part of the Mir station for US experiments, the purchase of [?an] Energiya booster, and an exchange of astronauts for flights aboard the Mir station and American Shuttle space ships.

Another exciting proposal is for a platform to be mounted jointly in space with the help of more powerful RD 170 rocket engine. Such a platform could be equipped with mirrors to divert radiation away from the earth and move sunlight to it. It also could be used to clean up space debris and even to reconstruct the ozone layer.

Mr. Simenov believes that Russia and the United States could join forces to implement the boldest projects and that citizens of the two countries would be the first to jointly step on Mars.

For his part, Mr. Truly spoke of NASA's interest in a number of Russian technologies, such as unmanned docking of spacecrafts, rocket engines, and small-size space-related nuclear reactors.

The agenda of Senate hearings also included the question of using the two countries' satellites as part of a worldwide anti-missile system, following a recent agreement reached in Moscow between the Russian President Boris Yeltsin and the American Secretary of State James Baker. As an initial step in creating a global ABM system the agreement played a crucial role in creating an atmosphere of openness in discussing the issues of joint space exploration.

NASA is expected to send a team of experts to Russia for technical assessment of the proposals and projects on offer.

Russian-American rapprochement has led both to a better international environment and to the opening of new opportunities for joint space exploration.

U.S. Personnel Flying Experiment on Mir Interviewed at Baykonur

*OW2702143992 Moscow Russian Television
Network in Russian 0800 GMT 4 Feb 92*

[S. Fedorova report from the "Kosmopolis" program on by Baykonur TV—recorded]

[Text] [Fedorova] Another liftoff, number 339 or 340—it does not really matter. It is just another planned liftoff for the testers of the spaceport. In a few moments the rocket carrying the Progress transport ship will be on its way, and after a predetermined time it will dock at the Mir orbiting station.

Flight Engineer Sergey Krikalev has been working on board the orbiting station since May 1991, and the commander, Aleksandr Vukob—since October. Aleksandr Viktorenko and Aleksandr Kaleri, who will replace them, are already in training.

[Vukob] I am convinced that our work is essential and it must not be curtailed or stopped, since we will have to go back to it no matter what, but the price will be higher. I think that people have enough common sense to understand this and to continue this program together with the participation of all members of the former Soviet Union.

[Unidentified cosmonaut] Space unites all people on earth. It would be good if everyone remembered it, and instead of scattering to their national homes and dividing our huge accumulated space potential, would cooperate in using it.

[Fedorova] Here at the exhibition grounds are those who have a business interest in space research. Please introduce our guests.

[Interpreter] This is the scientific director of our experiment. He is from the California Technological Institute.

[A foreigner introduces his colleagues and himself in English, which is then translated into Russian.]

[Unidentified foreigner] Assisting Dr. Strong is Doctor Barry (Stoddard) from the University of California, Berkeley. We have Maria Douglas from Payload Systems in Boston, Massachusetts....

[Interpreter, interrupting] And George (Birnbau), our client from Canada.

[(Crabbs)] I am Chris (Crabbs) also from Payload Systems.

[Fedorova] Thank you. I am Svetlana Fyodorova of the Baykonur TV company, and this is my colleague Olga Pastikhova and our cameraman Vyacheslav Sergayev.

Our American friends and colleagues have a certain interest in this space port. What is this interest?

[Chris (Crabbs) in English with simultaneous Russian translation] The fact that you have the orbiting Mir station makes your space exploration unique. The purpose of our experiment, which is to grow protein crystals in conditions of microgravity, demands extended stay in space. Therefore, we have come here to exploit the potential of your orbiting Mir station.

[Fedorova] Thank you. I wish you a successful stay here. All the best.

This is Oleg Vladimirovich Mitichkin, a representative of (NPO) Energiya. What are your objectives today?

[Mitichkin] Our objective is to guarantee the carrying out of a commercial experiment in producing protein monocrystals in space by the U.S. firm Payload Systems, which specializes in biotechnology. The goal of the experiment is to produce these crystals, which will become a source of scientific information for developing new, unique pharmaceuticals. Our facilities and our Soviet scientists are also engaged in such research. An analogous experiment which employs Biokrist instruments will be carried out on the Mir station.

[Fedorova] Are you sure of the success of your commercial enterprises?

[Mitichkin] We are not sure at all, but we are doing all we can so that the biotechnological space research would become very profitable for our enterprise, our country, and our pharmacological industry.

[Video shows interview with General A. Leonov.]

[Fedorova] Do you think the space port has a future?

[Leonov] I am sure of it. I do not think that even such a carved-up state as the one we have today will decide to close down all this. If one speaks of the future, one must start creating it today. If we close it down we will have no future at all.

Today, while accompanying someone here, I looked around once again and tried to see all that has been done here with new eyes. I was filled with pride. What smart people we are! Foolish people who never look ahead

could never create all this. We should be proud of it. What is more, so much has been invested here. We now have arrived at the time when this investment can be returned. So, when some representatives of social security tell us: "We have no medicine in our country, why are you talking about space flights?" I answer: If there are no space flights, there will be no medicine. We have already brought you more medicine than anyone else in the world has ever seen. Yet you do not want to consider this: to understand that if you do not invest 100 rubles today, you will lose a million tomorrow. What is more, everything necessary has already been built.

[Fedorova] Excuse me, but as far as I understand it, space research is nothing but a fairy tale without government support.

[Leonov] Well today we are like the kolkhoz which has said: Just do not stand in our way and let us use what we already have. This is a paradox that the money we have already earned through commercial flights has been taken away by the state. We could have turned this money into rubles and paid our people for their work. We could have survived even in this transitory, lean, and bad period, but even this money was taken away. On the one hand, they give us nothing; on the other hand, they take what we have already earned. Excuse me, but how can we live like this?

[Fedorov] By the way, some of my colleagues have published their own theory on this, saying that in Baykonyr they are taking their shoulder bars off. What is your reaction to this?

[Leonov] It is very easy to remove the shoulder bars. The question is whether it will improve the situation, and if the situation worsens, it is probably a bad move.

Today we have an organized system which has worked for many years, for decades. We have trained special service personnel, highly educated and well prepared officers, bound by oath and regulations. If we break up all this, we may lose a lot.

[Fedorova] The Baykonyr space port, 25 January, 1051 Moscow time. Another Progress satellite leaves the Gagarin launcher. Baykonyr lives and hopes.

Legal Aspects of SETI

927Q0071 Moscow *ZEMLYA I VSELENNAYA*
in Russian No 4, Jul-Aug 91 pp 75-79

[Article by G. V. Silvestrov, State and Law Institute, USSR Academy of Sciences: "Legal Aspects of the Search for Extraterrestrial Intelligence"]

[Text] The question "Are we alone in the Universe?" has apparently been asked for as long as mankind has been around. But not until our time did it become possible, thanks primarily to radioastronomy, to begin the search for extraterrestrial intelligence. As we know, among the existing means of communication, the radio signal is one

of the best carriers of information in the Universe. It is, therefore, no accident that in the early 1960s, several dozen experiments and projects in the United States, the USSR, Australia, a number of European states, and other countries were conducted with radioastronomy systems. Thus far, they have had negative results—no extraterrestrial intelligence has been found. At the same time, however, we know that important scientific results have been achieved in the course of the search. Scientists have not lost hope of finding extraterrestrial intelligence—after all, as of today, only a small part of the Universe has been studied, and many experimental capabilities have yet to be used.

The main tack taken in SETI is to "listen" to the Universe. Scientists hope that the extraterrestrial intelligence will eventually reveal itself. Another method of establishing contact consists in sending a signal (like a "message in a bottle") from Earth or from manmade space facilities in the Universe. Recently, amateur astronomers have been becoming ever more active in the search. Not having expensive instruments at their disposal, they are using amateur radiotelescopes in an attempt to detect the most powerful of any signals coming from extraterrestrial intelligence.

The growth of all this activity has brought on the need for appropriate legal regulation, since SETI could affect the interests not only of the scientists, but also of political leaders, religious leaders, and, in a broader sense, all of mankind. What might seem like a simple question comes up, for example: Should we send a reply signal if we detect an extraterrestrial intelligence signal? After all, strictly speaking, no one knows what the consequences of such contact would be.

As far back as in the beginning of the space age, specialists in space law devoted a number of studies to the question of future legal regulation of contact with extraterrestrial intelligence. In 1967, the Treaty on the Principles of Activity of States in the Study and Use of Outer Space was adopted, and it included the Moon and other celestial bodies. It does not, in fact, say anything about a search for extraterrestrial intelligence; but the tenets set out by the treaty have, undoubtedly, great significance for such activity. In particular, a search for extraterrestrial intelligence comes under the concept of "space research," the freedom of which is something addressed in the treaty.

Another international document—the Agreement on the Activity of States on the Moon and Other Celestial Bodies (1979)—addresses the obligation of states to immediately inform the UN general secretary, as well as the general public and the world community, if "signs of any type of organic life" are found.

On the whole, however, international space law does not contain any more or less detailed standards concerning SETI. And as far as we know, there are no such standards in the internal legislation of the countries conducting the search for extraterrestrial intelligence. That has

prompted the international scientific community to take measures to develop a document that would define at least some of the aspects of the activity associated with SETI.

The idea of the need for an appropriate international code of law has been expressed at many international conferences. The development of a first document was handled by the International Astronautical Academy (IAA) Committee for the Search for Extraterrestrial Intelligence and was completed in 1989. The leadership organs of the IAA and the International Institute of Space Law (IISL) approved a draft titled "Declaration of Principles of Activity Following Detection of Extraterrestrial Intelligence."

The declaration consists of a preamble and nine articles. It is nongovernmental in nature. The participants in the declaration can be national organizations, enterprises, institutes, or individuals who are conducting a search for extraterrestrial intelligence. The declaration regulates virtually no part of the search itself. **It takes effect the moment extraterrestrial intelligence is detected.** An important indication of the realism of the authors of the declaration is that they did not try to develop standards of "meta-law," i.e., standards about the relationship between earthlings and inhabitants of other planets. Rather, they focused their attention on the relationship among people (distribution of information, the holding of consultations, etc.) in the event that extraterrestrial intelligence is detected.

The declaration establishes that the search must be done for peaceful purposes only and must serve for the good of all mankind. The document's preamble acknowledges that the probability of detection is rather small. So what's the purpose of even having a declaration? As noted in the preamble, the adoption of the declaration is dictated by the fact that the detection of extraterrestrial intelligence could be of great import to mankind. In a matter so serious as contact with other worlds, it would be best to protect ourselves ahead of time and ready ourselves!

The purpose of the adoption of the declaration consists in effecting high standards in terms of scientific responsibility and reliability of information. That will help to raise the level of science in the search for extraterrestrial intelligence. The history of SETI knows a good many mistakes and embarrassments in which signals of a totally different origin were taken to be signals from extraterrestrial intelligence. The mechanism of verification provided in the declaration is called upon to help researchers avoid mistakes.

Imagine, for example, that a researcher detects "a signal or other evidence" of extraterrestrial intelligence. First of all, the discoverer must be certain that the most probable explanation for the origin of that signal is the existence of extraterrestrial intelligence, and not any other phenomenon of natural or anthropogenic origin.

The researcher is advised to take every measure to record and preserve any material traces of the detected phenomenon.

The declaration forbids the discoverer to send the extraterrestrial intelligence any sort of reply signal until the appropriate international consultations are held. The content and procedures of such consultations must become the object of a new treaty or declaration. That approach, in our opinion, is justified. Obviously, it would be too much of a risk to send a signal to any extraterrestrial intelligence without knowing what its response would be. After all, to assume that that intelligence is peace loving would be no more justified than to assume that it is aggressive. We have yet to determine who has the right to send a reply signal and to speak on behalf of mankind.

What, then, must the discoverer do? The declaration sets out in detail the steps he must take. First of all, he should inform the other participants in the declaration, so that they can set up simultaneous reception of the signals and form an observation network. The goal of such observation is to collect additional information, but its main purpose is to produce convincing evidence of the existence of the extraterrestrial intelligence. The discoverer must also report his contact with extraterrestrial intelligence to the appropriate government agencies in his country.

According to the declaration, the discoverer must relay the information through the traditional channel for transmitting astronomical information—the Central Bureau of Astronomical Telegrams. He must also relay the information to other interested international organizations—the International Telecommunications Union, the International Astronautical Academy, the IISL, and certain other organizations.

Only after the discoverer and the other participants in the declaration have made certain that the signals belong to extraterrestrial intelligence can any announcement be made to the public. The privilege of making the first such announcement of contact with extraterrestrial intelligence belongs to the discoverer. He must also send an official report to the general secretary of the UN, who, according to article XII of the Outer Space Treaty, must be ready to disseminate the information immediately and efficiently.

After those reports are made, information is disseminated through the usual channels. For the science community, they are publications and conferences; for the public, they are the mass media. All the information pertaining to the discovery must be accessible to scientists for further analysis and interpretation.

The participants in the declaration feel that if the carrier of the signal from the extraterrestrial intelligence is electromagnetic waves, then the International Telecommunications Union needs to take emergency measures to protect the radio frequencies that are used.

Finally, according to the declaration, after extraterrestrial intelligence is detected, a special committee must be quickly formed to serve as an analysis and coordination center, provide information to the mass media, and monitor observance of the tenets of the declaration.

The International Astronautical Academy has been appointed the depository of the declaration. The main function of the depository consists in collection and keeping documents that augment the declaration and in reporting to all participants the entry of new members.

The declaration was approved by authoritative science agencies—the councils of the directors of the IAA and the IISL. But that does not mean that the development of the legal bases of the conduct of the search for extraterrestrial intelligence is ended. The IAA Committee for the Search for Extraterrestrial Intelligence has been commissioned to analyze the experience recorded thus far in the application of the declaration and the procedures involved in the search for extraterrestrial intelligence and in the processing and storage of data. We can expect that the committee will emerge with new recommendations for the SETI researchers.

The national organizations, scientific enterprises and institutes, and individuals who are conducting the searches for extraterrestrial intelligence must now decide whether they will join the declaration. The declaration has been sent to the appropriate organizations. The fate of the document and the effectiveness of its use will largely depend on how the SETI researchers around the world look upon it.

A preliminary discussion of the document took place among Soviet specialists in December 1990 at a meeting of the section "Search for Space Signals of Artificial Origin" of the Science Council for Problems of Radioastronomy of the USSR Academy of Sciences at the State Astronomy Institute imeni P. K. Shternberg. The participants in the discussion reached the conclusion that the document is of interest to SETI specialists. At the same time, however, many who spoke noted certain ambiguities in the text of the declaration and controversial issues that could arise in the course of its use. A number of remarks and suggestions were made, and they will be consolidated and sent to the IAA. It was also decided to continue the discussion of the declaration in the Soviet science community. All interested organizations and enterprises, as well as individual researchers, can take part in that discussion.

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Azerbaijan Establishes National Aerospace Agency

LD2402001492 Moscow TASS International Service in Russian 0849 GMT 23 Feb 92

[By AZERINFORM-TASS correspondent Natan Barskiy]

[Text] Baku, 23 Feb (AZERINFORM-TASS)—A national aerospace agency has been set up in Azerbaijan.

The decree by the president of the republic notes that it has been organized with a view to implementing state policy in the sphere of opening up space, to developing and implementing national aerospace programs, and to coordinating work on international space projects carried out jointly with other states. The agency has been set up to make effective use of the available scientific and production potential in the interests of the national economy and the security of the republic.

The agency is based on the space research scientific and production association operating in Baku and is subordinate to the president of Azerbaijan, the document reports. It is entrusted with managing the research being carried out in the republic in this sphere, with developing aviation and space technology, with aviation and space services entry into the world market, and with the training and retraining of specialists.

Construction Battalion Mutinies at Cosmodrome

Barracks Set on Fire

LD2602195392 Moscow Teleradiokompaniya Ostankino Television First Program Network in Russian 1800 GMT 26 Feb 92

[Report from Baykonur by correspondent A. Gerasimov—from the "Novosti" newscast]

[Text] [Announcer] The reports which we have received from Baykonur are unpleasantly different from those which we are accustomed to receiving. Servicemen of a construction battalion have mutinied in Leninsk. Several hundred people took part in the disturbances. Here are the details:

[Gerasimov] Fire at the cosmodrome is a common thing. Each launch takes place in flames. But two days ago, it was barracks set on fire by construction soldiers that were ablaze. In this way, about 2,000 fixed-term servicemen protested their inhuman living conditions.

[Unidentified young soldier] I came here whole, healthy, unharmed, and now I have been serving here two years and I am going home sick, a cripple.

[Gerasimov] The hungry lads in the remnants of their military uniform, who had not had a bath since last October, moved in the direction of the city of Leninsk and took their demands to the command. Having broken through protective cordons of armed militia and the regular army, several hundred fighters [boyets] of the construction battalion got what they wanted. The medical certification of those who entered the Army by way of a misunderstanding over their white tickets [certificate stating medical unfitness] started today. The troops have been fed and salaries have been paid.

Despite the fact that criminal proceedings have been instituted against the instigators, the majority of the mutineers have been sent home on short leave. This typically army therapy has taken effect. The mutiny has in effect abated.

According to our information, happiness cost four burned barracks, three members of the construction battalion burned alive, 35,000 rubles stolen, and 17 hijacked vehicles. All this, incidentally, has in no way affected the space structures of Baykonyr.

Criminal Proceedings Instituted

*LD2602193992 Moscow Programma Radio Odin
Network in Russian 1600 GMT 26 Feb 92*

[Report from Alma-Ata by KAZTAG correspondent Vladimir Akimov]

[Text] The situation on the whole in the confrontation zone in Baykonyr has been taken under control by the military engineering subunits which arrived this morning. However, full normalization of the situation in the Army unit is yet to be achieved. That is why measures are being undertaken at present on the territory of the unit in order to strengthen the maintenance of order and to restore legality.

Yuriy Khytryn, state counsellor of the Kazakhstan president's apparatus, who is at present in the unit which is gripped by the disturbances, has revealed on the telephone that criminal proceedings have been instituted. An investigation has been launched by the republican procuracy. A Kazakhstan government commission is also investigating the causes of these incidents. According to the commission, irrespective of what actually sparked off the clashes, the true reasons lie in the extremely unsatisfactory social and everyday living conditions of the servicemen in the engineering forces, in bullying, and in cases of unfit young men being drafted.

The situation has been very greatly aggravated by the fact that there was not a single Kazakh officer in the unit, which mainly consisted of indigenous servicemen.

Situation Back to Normal

*OW2602185892 Moscow INTERFAX in English
1316 GMT 26 Feb 92*

[Transmitted via KYODO]

[Text] According to reliable sources, soldiers from the 17,000-strong engineering force servicing the Baykonyr cosmodrome staged a protest action in the Kazakh city of Leninsk on February 24-25.

Several hundred soldiers, mostly Kazakhs, marched on the city center on Monday [24 February] to demand the dismissal of officers who, they claimed, had repeatedly humiliated the junior personnel. They also called for a

cardinal improvement of food supplies and for better uniform and tobacco supplies.

The protesters said 300 to 400 servicemen in the Baykonyr Engineering Force must be barred from army service altogether for reasons of poor health officially certified by physicians.

Preliminary reports say four barracks caught fire for unknown reasons and 17 cars were stolen during the unrest. Three bodies were later discovered in one of the burnt-up barracks. Two were identified as those of Kazakh servicemen.

The government commission with State Counsel Yuriy Khytryn at the head has been flown to Leninsk to take urgent steps to stabilize the situation. The servicemen with health problems have been sent home together with those soldiers who have served in the engineering force for 18 months and more. All the rest were promised 10-day leaves and better food and tobacco supplies.

At present the situation in Leninsk is back to normal. The city is awaiting the arrival of Lt.-Gen. [Lieutenant General] Sagadat Nurmagambetov, chairman of Kazakhstan's National-Defense Committee.

It is possible that President Nursultan Nazarbayev, who has just returned to Alma-Ata after an official visit to Pakistan, will help settle the conflict at Baykonyr.

Further Details on Events

*PM2702145592 Moscow KRASNAYA ZVEZDA
in Russian 27 Feb 92 p 3*

[Report by Colonel A. Ladin: "Unrest at Military Construction Units. Many of the Soldiers' Demands Are Fair"]

[Text] Leninsk—Over the past few days there has been unrest, resulting in serious consequences, at military construction units carrying out missions at the Baykonyr Space Center. The details of these events were recounted to this KRASNAYA ZVEZDA correspondent by Major of Justice A. Nemkin, deputy military prosecutor at the garrison.

On the night of 23-24 February a large group of military construction workers—around 100 men—took over several trucks and drove to the military commandant's office to release colleagues who were being held there for disciplinary misdemeanors. The guards were forced to fire warning shots.

The lawbreakers then committed other offenses: They tried to rob the depots and burned three barracks. Three corpses were discovered in the aftermath.

A rally involving military construction workers was held at Tyuratam station 24 February. Various demands were made regarding Army service procedure, social, leisure, and other problems. In the opinion of the garrison deputy military prosecutor, who was an eyewitness to

some of the events of the past few days, representatives of informal social organizations were present among the military construction workers.

The garrison and military construction unit commanders met with those who took part in the disturbances.

Since 25 February a Kazakh Government Commission headed by Yu. Khitrin, Kazakh state counselor, and a commission headed by Major General [Maj. Gen.] A. Zavyalov have been at work at the Baykonur Space Center.

This KRASNAYA ZVEZDA correspondent asked Major General A. Zavyalov to make an assessment of what had happened. Here is what he said:

"I consider some of the servicemen's demands to be fair. A decision has already been made to allow a short home leave for 700-800 men with poor health, difficult family circumstances, or who have no work to do [ne zanyaty delom] at their subunits. At our request the Kazakh Government has allocated transport aircraft for those on furlough. During this period we will be trying to resolve the acute everyday problems of the personnel. With the help of the republic's leadership a monetary allowance has already been paid out to the military construction workers. Measures have been taken to improve catering."

According to Maj. Gen. A. Zavyalov, the situation at the Baykonur Space Center's military construction units has stabilized since 26 February.

Seven Officers Dismissed at Baykonur

*LD2702170292 Moscow Radio Rossii Network
in Russian 1200 GMT 27 Feb 92*

[Text] Kazakhstan's central newspapers have carried extensive articles today on the mutiny by military builders at the Baykonur Cosmodrome. The newspapers say that the causes of the disturbances include bullying by seniors, violence against soldiers and thefts from them by officers. Frequently, soldiers were left without hot food or water. They were forced to pay for their uniforms out of their own pockets. Now there is a government commission working among the construction units in the area of the Cosmodrome. It has been announced that seven officers have been dismissed from their duties. Many of the soldiers in the construction battalions have been granted short-term leave.

Commissions To Investigate Baykonur Mutiny

*PM2702192192 Moscow PRAVDA in Russian
28 Feb 92 p 2*

[Report by Georgiy Loriya: "The Military Show Their Mettle At Baykonur"]

[Text] Leninsk—Special commissions from Alma-Ata and Moscow, including representatives of the Kazakhstan State Defense Committee, Military Prosecutor's Office, KGB, and the CIS Unified Armed Forces Command have arrived at Baykonur.

They will be investigating the circumstances that led to the mutiny of several thousand soldiers from the space center's construction units. According to the statement by the troops themselves, their actions were prompted by bad service conditions, hostile commanders, and poor medical standards.

The military construction workers held a spontaneous rally at Tyura-Tam railroad station. It was also attended by sympathizers from among the local population. Several demands were made at the rally, in particular for the creation of normal conditions for service, the granting of leave, and the removal of a number of officers who, the soldiers claim, have discredited themselves.

The conflict had begun the day before, when one of the military construction workers was arrested and sent to the commandant's office. His comrades tried to help him by ramming the gates with a vehicle, whereupon the sentry opened fire, wounding one of the attackers. Then around 500 soldiers seized 15 or so trucks and that night drove off to the city of Leninsk.

According to available information, around 2,000 soldiers are not in their barracks at the moment. On their insistence they have been given refuge in Kazakhstan People's Deputy Major P. Chumachenko's unit.

City administration head V. Brynkin, who was appointed only a few days ago, promised the military construction workers that within a few days leave will be authorized for anyone who wants it. The command has issued an order on the removal of seven officers. The soldiers agreed to give their commanders 15 days to meet their remaining demands.

Ukraine Plant to Cease Military Production

*LD0203162592 Moscow Radio Rossii Network
in Russian 1200 GMT 2 Mar 92*

[Text] The Yuzhnyy Machine Building Plant in Dnepropetrovsk, one of the major military-industrial enterprises of the former USSR, will completely cease military production in the near future, the KHARKOV-NOVOSTI news agency reports. It was here at Yuzhmash that the production of intercontinental ballistic missiles was developed. At present the enterprise manufactures about 60 types of products for civilian use.

Parody of Cosmonaut Commo Sessions Underlines Program Problems

*927Q0093 Moscow NEZAVISIMAYA GAZETA
in Russian 26 Feb 92 p 8*

[Article by Andrey Bogoslovskiy: "'Vasilki' and 'Vityazi' (From the Log of the Space Station)"]

[Text] 27th

Taras and I soldered a lot of contacts this morning. Then we had a communication session. Ground Control said this:

"We'd like to congratulate you, Vityazi [*callsign*], about the democracy! Now you're free! We have a lot to do down here, guys!"

"That's fine, Vasilki [*callsign*]," we answered. "But what's happening down there with regard to our landing?"

"Be patient for now," they told us. "Democracy is no joke—it's a very complicated thing...."

OK, we'll be patient, although we've been aloft now for more than a year. We're feeling fine. All the equipment is working well.

13th

Communications with Earth were bad, but we managed to get through.

"When are you going to get us down?"

"Just wait a little longer, Vityazi," Earth answered. "You're so persistent. We can't think about you right now. At the moment we have an issue of principle: if the whites gorge on the browns, then the blacks will triumph and only the blues will come to power. Got it? Anyway, it's not to your benefit to get in a hurry: they raised your monthly salary to 140,000 rubles. That's how things stand. So long!"

OK, we'll be patient, although we're thinking about going home. Taras has been secretly smoking in the bathroom. We're feeling fine. All the equipment is working well.

10th

We were preparing the fruit flies this morning when, suddenly, Ground Control came on through the static—you could still hear what they were saying.

"Oh, bless your hearts! Vasilki!" we cried out. "When are you going to bring us down?"

"It's going to be kind of hard to bring you down," Ground Control said. "Things are...well, frankly, the site for your proposed landing is...well, outside the country. Even the Flight Control Center is right on the very border..."

"What are you saying!?" cried out my flight engineer, Taras. "Look, I don't give a damn what you do, Vasilki—I want to go home!"

"Calm down, Vityazi," they told us. "All is not lost. Zukin is standing behind you like a mountain, and democracy won't forget you. And as for money, they're paying you two million rubles a month, which is equal to four and a half dollars...."

Taras swore for a long time and did a bad job of soldering the contacts.... We're feeling fine. All the equipment is working well.

Whenever

After a hiatus of many days, the radio came up.

"Vasilki!" we bellowed out. "What's going on? Just when are you going to land us?"

"Be calm," they told us. "Don't panic, Vityazi. It's not easy. The Flight Control Center has been dissolved. We don't have any money, no food, they've inventoried all the furniture. They took Zukin's car away. Everybody's scattered all over. Something's wrong with the radio...."

"For Chrissakes!" Taras howled. "What, doesn't the homeland have time to care about us anymore?!"

"That's a good question," they said. "Which homeland are you talking about? You two belong to different sovereign states now, and the station is attached to a third. It's not an easy question...."

We were crestfallen.

"But, Taras, there's a new addition to your family!" Ground Control said happily. "You had a baby boy yesterday. He's 3,500 grams and 50 cm long. Congratulations, over...."

I congratulated Taras, too. We sat for a while and pined for home. It's tough without your relatives—after all, we've been up here in orbit a year and a half...We're feeling fine. All the equipment is working well....

279th

We spent the morning, without any pleasure, planting our winter crops. The forgotten radio squeaked on unexpectedly. We rushed to it, our hearts pounding.

"Vasilki, damn your mother! When in hell are we going to land?"

"I don't know anything about that" the voice weakly squeaked through in our headsets.

"Who are you?"

"I'm an amateur radio operator from Uryupinsk. And you're cosmonauts, right?"

"Yes, yes. What do you hear about us there?"

"That's a good question.... well, I haven't heard anything about you. Tell me, do you have any food up there?"

"Yes, we do."

"Well, what do you eat?"

"Well, soups in tubes, bread, all sorts of concentrates, dried fruits..."

"Wha-a-at!!!" the amateur radio operator said. "And you still want to come back to Earth???"

After conferring with each other, Taras and I decided to steer our own course, fix up the craft. We didn't even solder any contacts before going to sleep. We're feeling fine. All the equipment is working well.

Lost track of time

We peeked out the view port, and Good gracious! There was some spacecraft moored alongside us. Some spacesuits floated out of it and pointed toward the airlock as if we should open it. We opened it. They turned out to be some guys we knew—Bill and Gary, American astronauts. Well, we were all happy to see one another, and we joked. So what's happening? We came, they said, for your spacecraft. We're going to tow it back to the States and turn it into scrap. Your people sold it to us. How can that be? Who sold it? I guess it was when they sold everything, they said....

Taras and I knew something was very wrong.

"And what about us?" we whispered. "Us, the Vityazi?"

"That's a good question," Bill and Gary said, thinning about it. "Here's what we'll do. We'll tell the leadership of sovereign Koryakiya about you. They're urgently trying to put an army together, some retributational nuclear weapons, and a space program. Maybe they'll take you on."

As they said good-bye, our friends filled our tank with water and left us some grub, some Cokes, and some chewing gum. Taras asked for some jeans, too—not new ones, of course. Now he floats around elegantly in them in the compartments.

We're feeling fine.

As for how the equipment is working, I can't say—Taras privatized it all in one swipe an hour ago and won't let any outsider near it.

Early Space Failures Cited to Argue Against Continuation of Manned Flights

927Q0095A Moscow MOSCOW NEWS in English
No 9, 1-8 Mar 92 p 16

[Article by Leonard Nikishin: "Soviet Space Disaster on the Revolution's Anniversary. How and Why Cosmonaut Komarov Died"]

[Text] It's been 25 years since the spaceship Soyuz-1 disaster and the death of its commander, Vladimir Komarov. The details of what happened have remained a closely guarded secret. The tragedy indeed resulted from the policy of the Soviet Union's ruling elite who were trying to boost their prestige by scoring "victories" in the space race.

Soviet "superiority" in space exploration is perhaps one of the most durable myths created by official propaganda. The whole thing was started by the launching of the world's first satellite, and the mission of the first man to space. The world continued to talk about the "Russian miracle," despite the fact that the United States repeated the stunts just a few months later. The then Soviet leaders exploited the atmosphere for the maximum propaganda effect. They started a raucous about the "great advantages" of socialism, the nation's great deed in showing "the way" to the entire globe, etc.

Soon the Soviet space effort ran into crisis. The United States undertook a project to send astronauts to the Moon in response to Gagarin's challenge. While the USSR had no rival project, the Brezhnev government made a blundering attempt to emulate the Americans a few years later. The scheme was a total failure. The launches of the Vostok series probes ended in 1963 and the spaceship Soyuz on the drawing boards in Sergei Korolyov's design bureau was not to materialize before 1966. This was a space vehicle based on an entirely different concept, but having tasted "space victories," the leaders pressed Korolyov for more manned flights.

The designer, of course, couldn't do the impossible. But he had an accommodating idea for a quick refitting of the ship to carry several cosmonauts. The resulting vehicle was called the Voskhod. In 1964 three men flew into space. In 1965, Alexei Leonov made the first space walk three months before the Americans. The Soviet space walk nearly ended in disaster but it boosted the ego of the Brezhnev leadership and launched another round of back-patting. Korolyov, meanwhile, followed up by sending one Voskhod ship on a 30-day space mission and the other to test an artificial gravitation system. The overworked man ended up dying during major surgery.

His successor, Vasily Mishin, decided against the continuation of the Voskhod programme. Perhaps he wanted to start his work by launching a new type of ship, or play for time. He managed to convince the leaders that the "old junk" couldn't take the country far and would only increase the lag between the United States and Russia. The whole of 1966 saw no Soviet space shots while the Americans carried out Gemini flights and tested methods of manual-control docking.

In the absence of ground-based facilities for testing manned spacecraft, the Soviets tested them in space but unmanned. Late in 1966, the first unmanned Soyuz was ready for launching. The launch was a failure. Right after it was inserted into orbit, it was found that the craft could not be controlled without stabilization while the onboard engine was running. The craft couldn't leave its orbit for the same reason. It took uncanny efforts to slow down the craft, but its descent path proved too flat and the Soyuz would have overshot Soviet territory and could have fallen to China. The self-destruction system was activated and it was blasted apart.

The launch of the second unmanned Soyuz was also a disaster. First, the automatic equipment stopped the pre-launch procedure seconds before the ignition. The service trusses began to swing back, and members of the government commission hurried from the bunker towards the launch pad when suddenly there was a loud bang; it was the powder jets of the launch escape system going into action on command from the gyroscopes. This ignited the thermal control system. Within moments the craft's fuel tanks exploded and then the third stage blew out, along with the whole rest of the carrier. Luckily, all members of the commission and their chairman Gen. Kerimov and chief designer Mishin survived.

The third unmanned Soyuz launch was OK, except for the descent and landing stages. The front heat screen had a maintenance plug, and that spot burned through during the atmospheric descent. The craft landed on an iceberg in the Aral Sea (it was winter), crushed through, and floated in the resulting hole for some time before it became water-logged and sank. A special team of divers lifted it from a depth of ten metres.

Amazingly, following these disastrous results of the launches, a decision was made to carry out a space rendezvous, a docking of two spacecraft and their crews swapping the ships. The first to go up was the three-seater Soyuz with one man on board. The next day another Soyuz with a crew of three was to be launched. I'm trying to visualize members of the government commission voting for the project unanimously. I wonder why no one got up and said: What are we doing? How can we send up people after these disastrous test results? I think many must have had painful doubts. But the year marked the 50-year anniversary of the Russian Revolution and the pressure from the bosses to mark the occasion with a new space stunt was too great to withstand.

That the whole thing had gone awry was clear right after Soyuz-1, manned with Vladimir Komarov, went into orbit. One of the two solar battery panels failed to unfurl leaving the craft with a meagre power supply. Since Komarov's craft was supposed to perform the rendezvous and docking sequences that require much power, it became clear that the second launch with cosmonauts Bykovsky, Yeliseyev and Khrunov had to be called off. And it was, thank God.

The first orbital correction was widely off the mark because the manoeuvre thrusters' exhaust affected the operation of the altitude control system's ion sensors. There were some other minor glitches and the government commission had decided to cut the mission short by the end of the first day. At the appointed time, the ground control in Yevpatoria initiated the automatic sequence of altitude control, braking and descent.

The craft, however, refused to start its descent at the scheduled time. The cosmonaut reported a sudden failure of the altitude control and the engine failed to fire for braking. It was later discovered that Soyuz-1 had

gone into an "ion pocket" on the dark side of the Earth where the concentration of ions was less than the sensors could react to. The only alternative was to immediately utilize manual altitude controls. Komarov had to do this in the dark, because had he attempted to do it on the light side of the Earth, the craft would have landed outside the Soviet Union, which wasn't provided for. What was to be done?

Cosmonaut Belyaev, who two years before manually landed his Voskhod-2, was urgently flown from Yevpatoria to the coordination and calculation centre near Moscow where Dmitry Ustinov in charge of the mission had spent the previous 24 hours. Belyaev said it was quite possible to steer the craft by the light of the full Moon. Komarov received suitable instructions.

Early in the morning, the Soyuz-1 started its descent. Komarov acted impeccably and steered the craft precisely toward the landing site in the Ohrenburg Region. All communication with the cosmonaut stopped as scheduled after the separation of the capsule and everyone was eagerly awaiting news from the search helicopters.

Mission control communicated with the search centre over open radio lines, and the helicopter crews could only use a code language to describe what they saw. When one helicopter pilot saw the flaming wreckage of the spacecraft he reported only: "I see the object, the cosmonaut needs urgent medical attention out in the field." After this all verbal communication was cut, obviously, on instructions from the air force commander. That left Secretary of the Central Committee Ustinov without any information. He started to phone party secretaries in Ohrenburg and Orsk on a special line, but none of them could be reached. All had rushed to the landing site. Time passed but no news came. The cosmonaut was rumoured to have been sent to a hospital in Orsk. The craft landed at 7 am but Dmitry Ustinov still knew nothing by 10 am. At about 11 am he just got a call from Gen. Kamanin, who had visited the site. I don't know why it wasn't head of the government commission Kerimov. I don't know if they drew lots or just persuaded the general to break the news. Gen. Kamanin simply said that the mission had ended in disaster and Komarov's death.

None of the two parachute systems on board the craft was operational. The TASS report about entangled parachute lines served to conceal the real cause of the tragedy and it was written off as an accident.

What should have happened is: the parachute is packed in a container whose hatch gets jettisoned and the first to emerge is the so-called drag parachute, which is supposed to slow down the fall to 40 metres a second and pull out the main parachute which otherwise could be shredded by the impact of the violent air pressure. The drag parachute on Komarov's space capsule failed to pull

out the main parachute because the latter had gotten jammed in its container, flattened by the excess pressure inside the capsule.

A special instrument activated the backup parachute which usually emerges in the shape of a long "sausage" and then opens. Before it could open, the "sausage" got under the swinging drag parachute of the main system. Komarov must have realized what was happening seconds before the capsule hit the ground.

The descent capsule broke up and went up in flame. There were plenty of things to burn.

Dmitry Ustinov reported the disaster to Leonid Brezhnev at nearly 12 o'clock. Brezhnev was attending the international conference of communist parties in Karlovy Vary, Czechoslovakia. Ustinov then went to edit the text for a TASS report. The report went on the air 12 hours after the event. People refused to believe it, because everybody was convinced nothing could happen to Soviet cosmonauts. For a week or so it was rumoured that Komarov was safe and sound and that he had landed somewhere in Bulgaria or West Germany.

What remained of the cosmonaut's body was buried in the Kremlin Wall. Other remains found later by Young Pioneers on the site were buried right there, creating two burial places. Officials spared no effort to see to it that only the "official" burial place remained.

Komarov's tragic death is the handiwork of the ambitious and ignorant elite, as well as Brezhnev who envisioned himself the "father of cosmonautics." He was even decorated for "successes in space." The other people at fault are Secretary of the Central Committee Ustinov and those who eagerly carried out his instructions: I. Serbin, L. Smirnov, S. Afanasyev, K. Kerimov. Certainly guilty is the chief designer V. Mishin who yielded to pressure from officials of various ranks.

The tragedy didn't and couldn't teach anything to the conceited leaders. For more than two decades they boasted about Soviet edge in the space race (even after the Americans landed on the Moon) and insisted on fresh launches timed for big occasions. Only those who prepared those launches knew the truth. There were many accidents, disasters and dangerous situations over the years. It would suffice to recall the deaths of cosmonauts Dobrovolsky, Volkov and Patsayev on board Soyuz-11, the accident in the carrier that took Lazarev and Makarov into orbit, the disastrous inboard engine burnout during the first Soviet-Bulgarian flight, the failure in the carrier launching V. Titov and G. Strekalov. These were just manned missions. But there was the explosion during the liftoff of the giant N-1 rocket, the failure of one Salyut station immediately after it went into orbit—the list goes on and on.

The legitimate question is: what was it all done for? Why should such colossal funds and resources have been spent and such giant intellectual potential pressed into service? The obvious answer, I'm sorry to say, is all was

done for the sake of propaganda about socialism being a success story and in order to flex Soviet muscles. A host of people lived off it, but the net result is no economic gains, no scientific breakthroughs comparable to the money and effort invested.

Those who insist on the continuation of manned flights today, and bemoan the death of the space programme and the waste of the experience gained should not be believed. Some space projects really are in demand. People need space communications, navigation, weather service, surveys of the Earth's natural resources, etc. The efforts of the really top-notch experts should be switched away from the more useless and wasteful projects to those which can benefit people and the economy. Let's learn from the United States where, rich as they are, they are in no hurry to build orbital stations after burying themselves on the Shuttle programme.

'Cosmoflot' Company To Offer Commercial Space Services

927Q0096A *Moscow MOSCOW NEWS in English*
No 7, 16-23 Feb 92 p 10

[Article by Georgiy Nikityuk: "Cosmoflot Has Been Launched. Will Its Flight Be a Success?"]

[Text] Organizations and enterprises of the aerospace industries of Russia, Ukraine and Kazakhstan have set up a closed joint stock company COSMOFLOT. Among the company's promoters are: Energiya and Molniya, two well-known science-cum-production associations; the Cosmonauts' Training Centre; and the COSMOS concern which has been recently instituted on the basis of the Ministry of General Machine-Building. The new joint stock company is aimed at implementation of major scientific-technological space projects. Since commercial structures have been involved in the creation of COSMOFLOT, the latter is expected to be navigating the turbulent seas of the market economy before long. Assignments for space research programmes are getting smaller, so the involvement of the business organizations with structures which used to be purely state-financed will benefit the company. The company's president is the world's No. 2 cosmonaut, German Titov.

Dnepropetrovsk Company 'Gradient' Seeking Third World Space Business

927Q0097A *Moscow MOSCOW NEWS in English*
No 7, 16-23 Feb 92 p 10

[Article by Georgiy Nikityuk: "Small Enterprise Offers Space Satellites"]

[Text] A company in Dnepropetrovsk offers to design, build and put into orbit space vehicles, using the Tsiklon and Zenit boosters.

Such offers are quite real, considering that Gradient, the small enterprise in question, is a company launched by designers of the Yuzhnoye Design Bureau specializing,

in the past, in development of intercontinental ballistic missiles as well as shorter-range missiles.

Refusing to sign a Minsk agreement on joint (within the framework of the CIS) space research and development, Ukraine practically robbed the space designers of their jobs.

However, the designers refuse to be put out of work: Gradient experts have developed an automatic system for orientation of ground-based antennas of small-size commercial satellite-communications systems using low-orbiting space vehicles, for individual users. In addition, Gradient plans to set up production of different high-precision indicators, including gas analyzers, and devices for measuring magnetic dielectric parameters of materials.

Gradient is seeking orders from countries of the Third World which are actively developing their own space-missile programmes. The only condition is peaceful orientation of those programmes.

Gradient's telephone is (0562)65-1455.

Complaints of Baykonur Soldiers Confirmed

LD0403163592 Moscow Mayak Radio Network
in Russian 0900 GMT 4 Mar 92

[Text] Many facts set forth in the demands and statements by the Baykonur construction soldiers, who, unhappy with their lack of rights carried out violent protests, have been confirmed. This was stated to journalists by Yuriy Khitrin, state councillor of the Republic of Kazakhstan and a member of the government commission created to investigate the circumstances behind the unrest of 23-25 February, after his return today from the scene of the events.

He emphasized that in a number of units and subunits a situation had developed where regulations were flouted and beatings carried out and that the command of the Chief Special Military Construction Directorate was to blame for this. Officers paid practically no attention to the living conditions of the soldiers, who would go for weeks without taking a bath and who were poorly fed. Attempts to prevent the burning of barracks and buildings, the stealing of clothing and food, and desertion led to a number of officers receiving injuries of varying degrees of severity. A fire in one of the barracks killed three servicemen.

The republican procuracy has instituted criminal proceedings in all the crimes. The question of the liability of the guilty parties will be decided after a thorough investigation.

At the recommendation of the government commission, Major General (Chekov), the chief of the directorate, has been dismissed, along with several officers. The situation in the military construction detachments is now on the whole back to normal. Measures are being taken to restore the normal routine of army life; the barracks are

being repaired; and the questions of daily living conditions and the soldiers' food are being resolved, Yuriy Khitrin stated.

Causes of Troop Mutiny at Baykonur Detailed

927Q0102A Moscow KRASNAYA ZVEZDA
in Russian 12 Mar 92 p 2

[Article by Colonel A. Ladin, KRASNAYA ZVEZDA correspondent: "Baykonur after the Social Outburst"]

[Text] Leninsk—KRASNAYA ZVEZDA has already written about the critical situation that has arisen in military construction units deployed at the Baykonur cosmodrome. The outbreaks of disorder and burning of barracks, staff premises, and medical centers evoked a broad response in the armed forces and worried the parents of military builders.

It is easy to explain the general anxiety that has occurred. But how is what happened to be explained? Our correspondent reflects on this.

I flew to Baykonur already knowing about the alarming events. I could not grasp it all: People have died, and the losses are being counted in the millions.

While there I talked to many people. Various explanations were given for what happened. I also heard this: They said it was a kind of protest against the conditions of service. Fine, a protest. But it manifested itself rather strangely: Company storerooms and commodity and food warehouses of military construction detachments were ransacked. In one of them, commanded by Lieutenant Colonel V. Migalev, 200 kilograms of raw meat, 132 kilograms of cream, and 100 kilograms of vegetable oil were stolen.

Witnesses to the events that occurred noted that from the very first illegal acts there were civilians among the soldiers. During a meeting between staff officers and members of the state commission of the Republic of Kazakhstan, headed by commission chairman Yu. Khitrinnykh, and also Colonel General N. Chekov, deputy commander in chief of the Combined Armed Forces of the Commonwealth of Independent States for construction and billeting of troops, speakers said that they could not believe that soldiers, sergeants, and military construction personnel, gathering spontaneously, could come up with the idea of arson and the attempt to put electric substations out of commission. After all, there was an attempt to shut off the valve of the water pipeline that supplied Leninsk, and this was generally almost accomplished. Fortunately, a misfortune was successfully avoided.

Again the question: If someone directed the actions of the servicemen, what objective did these people have? Some offer the following explanation: that this is a protest against the presence of military construction personnel at the Baykonur cosmodrome. They say that the settlements situated near the cosmodrome also know

of cases of rudeness and the poor everyday conditions that exist in the collectives of the military construction personnel, and that they cannot reconcile themselves to this.

It is true that it is not possible to tolerate this. But, on the other hand, these questions were discussed without excessive passion and with concern at a meeting between Lieutenant General S. Nurmagambetov, chairman of the State Defense Committee of the Republic of Kazakhstan, and representatives of the public and elders of the Tyuratam station. The people were even ready in some way to help the command eliminate deficiencies. It is hardly likely that this would be a concern for those, for example, who set fire to the medical station or the barracks, considered to be among the best in living arrangements. Somehow it is not believable that such actions were blessed by noble intentions.

Unfortunately, there are as many reasons as you can imagine for the expression of dissatisfaction today. And not only in Leninsk, and not only in one or another military construction detachment. Lieutenant General S. Nurmagambetov told me about this when I asked him to come to Baykonur and give an assessment of what happened. Sagadat Kozhakhmetovich emphasized that many problems have been growing in severity for a long time. This was apparent. But the state system that existed before, figuratively speaking, put the missile in first place, and everything that was earmarked for people—housing construction, social facilities for soldiers and military construction personnel—and for officers' and warrant officers' families was done last with little means. Many social living condition questions were by far not decided at the level that ensured the realization of fantastic space projects.

So, I repeat, military construction personnel have more than enough reasons for an expression of dissatisfaction. But take the tardy payment of monetary wages. Who would take it in his head not to issue pay to military construction personnel when there was money in the account of Glavspetsvoenstroy [Main Directorate of Special Military Construction]? The client, in the form of the Department of Space Systems of the CIS Combined Armed Forces, did not settle accounts with the military construction organizations of Baykonur for December of last year and for two months of this year. In the words of Major General B. Kalinichev, chief of the Engineering Directorate of this department, the debt already amounts to 612 million rubles. But how can payment be made, when the financing of space programs has been practically stopped. Colonel A. Bilichenko, the chief economist of the construction main administration, added to this: Loans amounting to 20 million rubles have already been activated at the bank to continue the work that has been started on installations at Baykonur.

It would seem that not much is being said about the fact that the cosmodrome is needed by all the republics of the former Union. It would seem that it is perfectly clear that reliable modern communications are assured because of

space equipment, and that cartographers, geologists, and meteorologists use it to resolve their tasks. But questions of finance are not being resolved. Baykonur is eagerly awaiting specific agreements from the heads of state of the CIS, who are to assemble on 20 March for the next session in Kiev. At present, only Kazakhstan has allocated 50 million rubles, which is directed to support the social services of the city of Leninsk. But there were only enough resources for January and February; how to live beyond this is unknown.

The same Major General B. Kalinichev, apparently not laying it on thick at all, said that if the question of financing space programs is not resolved, Baykonur expects a real catastrophe. In his opinion, a billion rubles are needed.

The latest events in the Baykonur military construction units have suggested the idea to many managers that, since the client today is not in a condition to pay for construction work being conducted at installations, the number of military construction detachments should be reduced.

But it is hardly likely that this kind of a decision will please everyone. Major General Kalinichev thinks that this should not be done. It is not a question of erecting new installations, although there will be no one to maintain those that exist in operating condition.

The military construction personnel are also "tied" to other regional problems. They erected schools, clubs, and other social facilities on adjacent and remote sovkhozes and kolkhozes. They also drilled and readied for operation seven of 22 water wells intended to supply population centers near Baykonur. They were planning to participate in the implementation of programs to equip zones of the Aral Sea and build canned food plants and agricultural processing shops. If the military construction personnel leave, it is unlikely that these ideas will be carried out. It can be assumed that everyone who intends to live and work in Leninsk on behalf of the development of advanced directions in the space sciences is counting on improved living conditions.

It would be good, of course, if all of these problems were resolved without military construction personnel. But for the time being this is only wishful thinking. Since this is the case, however, it is time seriously to get down to providing good quality living and service conditions. But it is also impossible to forget the missilemen at the cosmodrome, who have no fewer problems. Among them there are many who have given their entire lives to the cosmodrome. Really, do these people not deserve better treatment?

Head of New Russian Space Agency Interviewed

PM0503102592 Moscow IZVESTIYA in Russian
28 Feb 92 Morning Edition p 5

[Boris Kononov report incorporating interview with Yu.N. Koptev, general director of Russian Space Agency; place, date not given: "Russian Space Agency Set Up"]

[Text] The Russian Space Agency has been set up by a decree issued by Russian President B.N. Yeltsin. Yuriy Nikolayevich Koptev has been appointed its general director.

He is 51 years old. He is a graduate of the Moscow's Bauman Higher Technical College. He rose from being an ordinary engineer at the Lavochkin Science and Production Association to the post of deputy minister of general machine building of the former USSR. He has led a whole series of important space-rocket projects.

He believes that his main task in his new post is to radically reorganize the work of the space-rocket sector in Russia in line with the principles of rationalism, democratization, and commercialization. The lion's share of the former USSR's space-rocket complex belongs to Russia. Russian enterprises executed 85 percent of the entire space-rocket program. There are two cosmodromes in Russia—Plesetsk and Kapustin Yar. Last year 60 percent of all space launches were carried out from the Plesetsk launchpads.

The former USSR's space-rocket complex is now located on the territory of six CIS countries, and one of the central tasks of the new agency is to organize their effective cooperation within the framework of the agreements that have already been reached.

"Our agency will now be on the small side, employing about 150 people," Yu.N. Koptev says, "by way of comparison I ought to mention that 10 times that number of specialists work at NASA's headquarters. Leading scientific organizations will clearly be subordinated to the agency. Despite the country's grave financial situation, funds are being allocated to maintain the sector's activity at roughly the same level as last year. Our agency will play the role of the state management organ and act as the customer while projects are being formulated and developed. When the systems are up and running, it will be expedient to hand these functions over to consumers. Every project will now begin with a competition, all the proposals will be analyzed at the agency and undergo expert appraisal involving the recruitment of scientists and the necessary specialists. At the same time an independent assessment will be carried out by the Interdepartmental Commission for Expert Appraisals of Space Projects. Once priorities have been determined and the budget ratified by the Russian Supreme Soviet, contracts to realize the projects will be concluded."

[Konovalov] What future awaits manned spaceflight?

[Koptev] We do not intend to torpedo either manned spaceflights, or scientific projects, or national economic satellites, or the dual-purpose systems that are essential for the security of our state. However, the agency intends not only to attract budget funds but also commercial structures, and it plans to exploit international cooperation more widely.

The USSR's former commitments will be met. At the same time we realize that the "Mir" station has been in operation for a long time now. In one and a half to two years' time its base module will need to be replaced. This is a costly project.

It has not been ruled out that we will attract international capital and set up a joint-stock company to jointly operate the "Mir" station. After all, mankind will not have another orbital station prior to 1996 at the earliest. Intensive talks are currently under way with the United States, and it seems that a new agreement to strengthen our space cooperation will be signed this summer.

Ability of Ukrainian Group to Conduct Space Launches Questioned

PM0903150992 Moscow KRASNAYA ZVEZDA
in Russian 5 Mar 92 p 4

[Reply to reader's letter by Lieutenant Colonel M. Arkhipov, senior officer at the CIS Joint Armed Forces Space Systems Directorate: "The Payloads Are Foreign..."]

[Text] The DELOVOY MIR newspaper published an advertisement by the Dnepr Region Commodity Exchange (Ukraine) offering to perform the whole range of work to launch various satellites into space orbit using "Zenit-2" and "Tsiklon" launch vehicles from the Baykonur and Plesetsk cosmodromes. But, as far as I know, the launch of all space vehicles and their control is performed by space units. I wonder how much the military department will get for this?

[Signed] A. Ustimenko, Yekaterinburg.

Lieutenant Colonel M. Arkhipov, senior officer at the CIS Joint Armed Forces Space Systems Directorate:

The advertiser claims to have the capability of placing payloads into spherical and elliptical orbit, but this is unrealistic. The country's major and unique enterprises in the space rocket industry, which were nationalized by Ukraine on the basis of territorial ownership in the period of the disintegration of the USSR, cannot put even the tiniest rocket into space without launch systems or test ranges.

The space units, which perform launches of all types of satellites named in the advertisement from the Baykonur or Plesetsk cosmodromes, have no relationship with the market. The leadership of the Dnepr Region Commodity Exchange which "threw" the new type of "space service" onto the international market should first of all think whether civilian specialists in the republic space industry can perform the work advertised in view of the lack of opportunity to launch space vehicles from the launch facilities of cosmodromes which are still the property of the Armed Forces. After all, the mere procedures for preparing a typical satellite for a minimum period of 14 weeks costs around \$750,000 (\$53,000 a week), and the

cost of preparing similar U.S. launch vehicles for launching is estimated at a sum between \$40 million and \$70 million. You can convert this into rubles yourself.

Incidentally, throughout the whole history of our cosmonautics, this work was performed free of charge as part of the space units' military budget. Thus the question of how much will be owed, and to whom, by the Ukrainian commodity exchange and space industry enterprises in this case remains open....

Brazil Interested in Employing Space Experts

*LD1103222792 Moscow Radio Rossii Network
in Russian 0900 GMT 11 Mar 92*

[Text] Brazil is showing great interest in CIS scientists to work for its national space program. As Brazilian papers reported on Tuesday [10 March], the Brazilian Technological Aeronautics Institute is concluding contracts with Commonwealth scientists. It is assumed that a group of 20-25 space specialists will be looked for in the CIS to sign contracts. They are expected to arrive in Brazil this year. At first the experts from the former USSR will lecture and conduct practical training, and later they will help the space program itself. According to local media, the salary of the CIS scientists will be \$2,000. Commenting on the reports, a Brazilian Foreign Ministry spokesman pointed out that it was not a question of the scientists emigrating but of signing temporary contracts.

Moscow Institute Developed Space Laser Systems

*927Q0084A Moscow NEZAVISIMAYA GAZETA
in Russian 26 Feb 92 p 2*

[Article by Dmitriy Frolov: "Space Superweapon Did Not Go Through: This Did Not Grieve Its Creators Too Much. They Are Ready To Heat Our Homes"]

[Text] Science

From the outside, the Institute of Thermal Processes looks typical: The usual absence of signs at the entrance, an alarm system on the top of the fence like those that surround "sacred boundaries," and in the yard in front of the administrative building, not intended for strangers' eyes but designed to fill employees' hearts with pride, is a model of a renowned product—in this case, the multiple rocket launcher Katyusha—in a word, the entire gentlemanly framework of an ordinary secret "post office box" is present. This ordinariness, however, is a sham: It is not every defense scientific research institute that can brag about participation in such a global project, for example, as the creation of one of the key components of the Soviet star wars program—a combat space laser.

Originally, this gas dynamics unit was not intended for such specific purposes. When it appeared at the beginning of the 1970's, a power of 100 kilowatts was an achievement in itself. However, it is not difficult to imagine that the ability to cut a metallic plate the

thickness of a finger gave birth to a picture in the mind of the military that was no less impressive than the destruction of an aniline plant and the cutting up of flying airplanes in the once popular novel about engineer Garin. Most likely, the gas laser was only one of the contenders for the role of an outer space hyperboloid; however, in the opinion of specialists, it had real chances of becoming one. The wreck of the orbital station "Skif", aboard which it was planned to conduct an experiment of this program, well-known political changes in the country and the world, and material conditions prevented the completion of the project—a prototype of the superweapon remained on the grounds of the institute in a building whose interior more closely resembles a neglected workshop than a weapons test stand of the 21st century. Today, with the help of this laser, contractual work is being completed on the selection of industrial welding modes.

Literally within several dozens of steps there is another sight at the institute from the once popular series of claims of being "the first and the best" in everything. A cyclopean laser, whose average estimated power reaches 10 megawatts, has been installed in the rebuilt three-story building of a former boiler plant. With the help of a system of mirrors nine of its rays, each the thickness of an arm, are joined into one with a diameter of only 50 millimeters. This structure was intended for experiments on the creation of a space laser engine. The principle of its operation was rather simple: A gas serves as the working medium for the creation of reactive propulsion—for example hydrogen, which expands in the engine chamber under the ray of a gigantic laser that is located on the ground. It is perfectly obvious that the embodiment of such a "simple" principle requires the implementation of unbelievably complex technical decisions and their corresponding costs. No one knows for certain how much the first stage of construction of the laser giant cost. Also unknown is to what degree our capability to create an automated guidance system corresponded to such a global task; thus, the entire project either fell into the sphere of scientific fantasy, or was realistic nonetheless. In any case, by 1991 the program was halted for a long time, if not forever.

Both of the aforementioned curiosities are located in premises leased today by the limited-liability scientific production company NIITP-FOR [Scientific Research Institute of Thermal Processes; expansion of FOR not given]—a firm that considered itself the successor to the school of Keldysh and Petrov, which emerged on the basis of one of the departments of the institute which was working on the basis of the intellectual property accumulated there and was using institute equipment. The sphere of activity of this commercial subdivision not only lies outside a "defense establishment" that no one needs but is also not associated with highly scientific global projects. Thus, the most promising here (not in the sense that it is remote, but, to the contrary, that it is realistic and guaranteed to be profitable) is believed to be the creation of gas heat generators—aggregates for the

decentralized heating of homes. The concept of a centralized heat supply, which was cultivated everywhere as a logical continuation of the system of centralized distribution, in the end discredited itself, and only the relatively mild winters of recent years saved us from considerable unpleasantness. The producers of autonomous heat generators were faced with a market that was not spoiled by much choice. Until now, the Soviet units that were produced could not satisfy the market and were bought up quickly, although they did not withstand any serious criticism about their performance. Those that are being produced here can compete with the best of Western models: The absence of rotating parts—a guarantee of durability—an original thermodynamic scheme that assures full combustion and, consequently, good ecological indices, and an unprecedented efficiency factor—up to 95 percent—more than modest in size (the generator, which is capable of providing heat to the whole entrance of a five-story house, is shoulder high and a little wider than the average man)—all of this indicates that this instrument was created by a class of specialists much higher than those who were engaged in this kind of development earlier. This in itself, undoubtedly, is fine, and there is no need in today's situation to weigh how reasonable it is to utilize such unique specialists in this way—in any case, of the hundreds of scientific collectives living with outstretched hands on a hunger

ration there is now one less. Moreover, the scientists themselves do not consider themselves to be wasting their skills.

"No less complex and interesting technical tasks have to be resolved than was the case previously," says the director of NITTP-FOR, Gennadiy Yevseyev. "We are professionals, and therefore we are guided in our evaluation by criteria other than the momentary prestige of a subject, and, after all, if we are to speak frankly, what is prestigious in military space developments—which in contrast to our generators do not warm anyone—what is important is the approach and the level of technology that is utilized. Moreover, we do not intend to work on heating equipment all our life, and, I assure you, there are many areas where our experience will be useful. A unit for extinguishing fires at oil and gas wells with supersonic streams is slowly taking on a metal form. There also are other ideas: Our lasers will not be transformed into museum exhibits, but it is better not to talk about this now—you yourself understand, a commercial secret."

Thus, the institute, never suffering from a shortage of all kinds of secrets, will remain a restricted zone as before—as previously, the perimeter will be "swept" by television cameras, the monitor will not be removed from the telephone, and the first department will not be cut. But if all of this complex administration protects not war but commerce, what is so bad about this?

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